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International Symposium on Fisheries and Aquatic Sciences

25-27 October 2022

Central Fisheries Research Institute

National Fisheries Gene Bank

Oral Presentations

## Review of Aquaculture Systems of Georgia, Current Condition and Future Perspectives

Tuesday, 25<sup>th</sup> October – 14:00 - Main Conference Hall – Oral

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Development of aquaculture as feed industry began nearly a century ago in Georgia. Along with development, the industry underwent many changes ever since. Until the beginning of the 1930s, the supplier of fresh fish in Georgia was marine and later inland (lakes) fishing. For this purpose, a fishery and fishing scientific station was established in Batumi. In the 1960s it was reformed into a department of the All-Union Scientific Research Institute of Fish Farming and Oceanography. Its main purpose was ichthyological research and aquaculture development. In 1932, the first fully established aquaculture system – Japan pond farm was created in Lanchkhuti municipality. Its area together with National water reservoirs was 240 hectares. The farm produced 140-160 tons of fresh fish under monoculture of carp and 260-320 tons of fish using polyculture (phytophagous fish). The farm supplied with seed stock many fish farms created later. At the end of the 1930s, in the reservoirs of the Javakheti highlands, an aquaculture farm of freshwater whitefish species (Coregonidae) was established, which is still successfully functioning today. In the post-war period, especially in the 1960s and 1970s, several full-scale aquaculture farms with reproductive rearing equipment and many fattening farms with commercial production were built in western and eastern Georgia. A polyculture of carp and phytophagous fishes of the Chinese carps (bighead carp (*Aristichthys nobilis*), silver carp (*Hypoptthalmichthys molitrix*) and grass carp (*Ctenopharyngodon idella*) were created. As a result, the fish productivity of the ponds increased significantly. In the scientific department, under the leadership of Rezo Goradze, new high-productivity technologies for the reproduction of warm and cold-water fishes were intensively elaborated. As a result of multi-year selective breeding works in Japan pond farm, he created new fast-maturing high-yielding varieties of carp and phytophagous fish (bighead carp (*Aristichthys nobilis*), silver carp (*Hypoptthalmichthys molitrix*) and grass carp (*Ctenopharyngodon idella*), which are the main objects of cultivation in ponds and reservoirs currently. G. Barach, O. Burchuladze and R. Goradze devoted many years to carry out scientific-experimental works on the reproduction of Black Sea salmon (*Salmo labrax* Pallas 1814) and sturgeon species, as well as stable replenishment of their stock in natural reservoirs in the fish farm of Gudauti, Kodori, Rioni and Adjara salmon breeding rivers. In the 1970s, under the initiative of A. Komakhidze and R. Goradze, the acclimatization and naturalization of new species- The channel catfish (*Ictalurus*

*punctatus*) and African catfish (*Clarias gariepinus*) were carried out in water reservoirs of Georgia. In the early 1980s, the area of pond farms was 4100 ha, the production of fresh fish produced by the method of polyculture exceeded 5000 tons. In 1990-2000, Georgia and neighboring countries were engulfed by an economic crisis. The country's food supply system was destroyed, many successful fisheries went bankrupt and were destroyed. They were unexpectedly privatized, which led to the complete collapse of the industry. The annual production of aquaculture decreased to 500 tons. The revival of aquaculture began in 2008 with the development of small industrial enterprises using earth, concrete, and plastic tanks. They mainly produced rainbow trout (*Oncorhynchus mykiss*) and sturgeon (Acipenseridae) at some extent. Preserved extensive aquaculture pond farms produced fish without the use of feeding or reclamation methods. Intensification methods were implemented in semi-industrial and industrial farms, where bester sturgeon, Russian (*Acipenser gueldenstaedtii*) and Siberian sturgeons (*Acipenser baerii*), their hybrids, Colchic sturgeon (*Acipenser persicus colchicus*), European catfish (*Silurus glanis* Linnaeus) and African catfish (*Clarias gariepinus*), selective breeds of carp and others were bred. By 2021, the total area of pond farms was 2450 ha, number of fresh fish produced in them ranged from 3000 to 3800 tons. Among produced aquaculture products 60% came from carp, 26% from Salmonidae (different forms of rainbow trout, palia and their hybrids), 12% from sturgeon and 2% from catfish. The area of industrial and semi-industrial farms is 27900 m<sup>2</sup>, fresh fish production is 1395 tons. The total area of extensive aquaculture reservoirs is 20,000 ha, the annual production of fish is 1340-1400 tons. As for mariculture, with the participation of our and foreign (Norway, FAO) scientists, many experimental biotechnologies for breeding fish, mollusks, aquatic plants and crustaceans have been developed, although many attempts at industrial production have ended in failure due to the lack of estuaries and bays on the coast, as well as severe storms. Recirculating aquaculture system (RAS) has great potential to develop sustainable aquaculture. It is especially important for developing countries, including Georgia. In Georgia, there have already been several attempts to set up a recirculating water supply system using Russian equipment and technology, which were unsuccessful. The state's policy towards aquaculture gives hope that the development of the industry will take place in accordance with sustainable principles. The law of Georgia on Aquaculture which came into force in 2020 underlines the importance of Aquaculture sector for the country, promoting responsible and sustainable development of aquaculture. The country's Aquaculture development program (2022-2031) sets a goal to develop an innovative type of fish farming industry, ensuring sustainable use of the country's water resources, which will enable to achieve the highest possible level of self-sufficiency in the domestic market with fish and fish products, as well as to ensure global competitiveness of manufactured products and services. For the development of fish farming in Georgia effective steps should be taken. Main goals should be shifting to an innovative type of industry with sustainable use of biological resources and introduction of advanced technologies in the fields of fish production, breeding and processing.

**Keywords:** Aquaculture, Georgia, RAS, fishery, Black Sea salmon (*Salmo labrax* Pallas 2014), Colchic sturgeon (*Acipenser persicus colchicus*), rainbow trout (*Oncorhynchus mykiss*), Salmonidae, polyculture of carp.

## Determination of Abant Trout (*Salmo abanticus* Tortonese, 1954) Alevin Yolk Sac Consumption by Egg Size

Tuesday, 25<sup>th</sup> October – 14:15 - Main Conference Hall – Oral

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The main target of this study was determined of the effect of egg size on the yolk sac consumption during the alevin period of Abant trout. There were 3 different egg size groups, and these groups were named accordingly their average size as 5.25 mm, 5.50 mm, and 5.90 mm. At the beginning of the experiment, the eggs which were used in this experiment, taken from 4 broods. After the fertilization, the size of egg was measured for each brood. This experiment took 28 days, and samples were taken once every week except the last week. On the last week, to not miss the yolk sac consumption point two samples were taken on the 4<sup>th</sup> and 7<sup>th</sup> day of the week. This study was conducted to determine the effect of egg size on alevin stage development.

The length of alevins was measured in 5.25 mm, 5.50 mm, and 5.90 mm as  $21.15 \pm 0.71$  mm,  $21.90 \pm 0.57$  mm,  $21.80 \pm 0.95$  mm, respectively and no statistically significant differences were found among groups (ANOVA,  $P>0.050$ ). Each groups consumed their yolk sac completely in the 5<sup>th</sup> sample (25<sup>th</sup> day). At the end of the experiment, wet weight of alevins was reached from smallest egg size to larger size as  $103.17 \pm 12.19$  mg,  $115.47 \pm 9.17$  mg, and  $114.16 \pm 11.51$  mg. Dry yolk sac consumption was calculated  $0.64 \pm 0.05$  mg/day,  $0.81 \pm 0.10$  mg/day, and  $0.75 \pm 0.07$  mg/day, respectively and the difference between groups were significant (ANOVA,  $P<0.001$ ) but 5.50 mm and 5.90 groups have shown similarities following Tukey's Tests. The yolk sac conversion efficiency between groups were similar (ANOVA,  $P>0.050$ ).

As conclusion, although the 5.90 mm group was the biggest, the 5.50 mm group showed close growth performance, moreover the 5.50 group's dry yolk sac consumption value was a bit higher than the 5.90 mm group. The eggs that had size higher than 5.50 mm should be selected for the preparation of good broodstock.

**Keywords:** Abant trout, *Salmo abanticus*, Yolk sac, Egg size, Alevin period.

## Molting Frequency, Survival and Growth Performance of Blue Swimming Crab Instar (*Portunus pelagicus*) Using Combination of Treflan and Furazolidone as Therapeutants

Tuesday, 25<sup>th</sup> October – 14:30 - Main Conference Hall – Oral

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The use of antibiotics and other chemicals in aquaculture is widely practiced to help meet the increasing demand for aquaculture food commodity. Antibiotics such as Treflan and Furazolidone are used in the larval rearing of tiger prawn and other shrimp to improve survival rate of postlarvae under captive condition. In this study, the combined effect of Treflan and Furazolidone on the molting frequency, growth performances and survival of blue swimming crab instar (*Portunus pelagicus*) reared in fiberglass tanks were determined. Two treatments with 3 replicates each were tested. Twenty (20) individual crab instars of uniform size were stocked per circular fiberglass tanks each with water capacity of 200 L for 37 days culture period starting from crab instar up to the juvenile stage. Treatment I corresponds to the control with no application of Treflan and Furazolidone (NTF). Treatment II represents the use of Treflan and Furazolidone (TF) at the rate of 0.2ml per ton of water and 0.3g per ton of water, respectively. The result showed that the growth, survival, and molting frequency of blue swimming crab instar *P. pelagicus* were not significantly different ( $P>0.05$ ) by the application of TF at the end of culture period. In both treatments, survival rates always decline due to cannibalism and this is the primary reason for descending rates. Hence, the use of TF may be true for other crustaceans such as shrimp for the enhancement of molting, growth, and survival, but adverse for blue swimming crab instars.

**Keywords:** Blue swimming crab, furazolidone, instar, therapeutant, treflan



## Effect of Different Inorganic Substrates on Growth Performance of African Catfish (*Clarias gariepinus*, Burchell 1822) and Lettuce (*Lactuca sativa* L.)

Tuesday, 25<sup>th</sup> October – 14:45 - Main Conference Hall – Oral

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The aquaponics system recirculates decomposed nutrients, fish feces, and uneaten feed into the recirculated aquaculture system. Lettuce (*Lactuca sativa* L.) is one of the most preferred vegetables to grow in aquaponics due to its highly effective products, but there are few studies on this subject. In this study, four different kinds of inorganic substrates were used to determine the growth parameters of curly lettuce in Nutrient Film Technique Aquaponics. The study was conducted in Antalya, Turkey, under typical climatic conditions. Fibre, rock wool, zeolite and gravel materials were used, and the ratio of water flow was 0.3 L/min. At the end of the trial, the feed conversion ratio of the catfish (*Clarias gariepinus*) was calculated to be 0.658. the yields of lettuce and catfish growth in the system were determined to be as follows: total average = 5.603,82 kg/m<sup>2</sup>; zeolite = 6.067 kg/m<sup>2</sup>; fiber = 5.072,22 kg/m<sup>2</sup>; rockwool= 4.934,03 kg/m<sup>2</sup> and gravel= 5.382,64 kg/m<sup>2</sup>. And the specific growth rate of fish was measured to be 2.3%. In our aquaponics integration, no statistically significant growth difference was found for lettuce between these inorganic substrates or between catfish and lettuce.

**Keywords:** Aquaponics, inorganic substrate, fish, lettuce, growth performance

## Fattening of mangrove crab *Scella serrata* fed with two different diets (trash fish and stingray) at Sitio Sindang Indanan Sulu, Philippines

Tuesday, 25<sup>th</sup> October – 15:00 - Main Conference Hall – Oral

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Mangrove crab *S. serrata* fattening has been practiced in the Philippines and considered to be ecologically sustainable. One of the best natural foods for fattening of crab culture is Trash fish. Meanwhile, stingray is also containing proteins which quietly abundant in the Southern Philippines and which are not economically valuable that would have been discarded by most people due its unpleasant taste. Considering this, the present study is to determine the effects of two different diets on mud crab fattening using modified plastic cages in mangroves area. The experiment was conducted at Sitio Sindang, Indanan, Sulu, Philippines for 30-day fattening period. 12 adult crabs were reared into two modified plastic cages measuring 17cm (W)x 24.5m (L)x 6cm(H). Plastic cages were partitioned into 6 compartments, each compartments contained one crab. Two types of experimental feed namely; stingray (chopped stingray) as treatment-1 and trash fish (entrails of fish and chopped trash fish) as treatment-2 were given to the experimental crabs. The amount of feed given to the crab was calculated based on the 10% body weights. The crabs fed with chopped stingray mean weight value is  $103.33 \pm 34.12$  g and fed with trash fish is  $71.66 \pm 22.86$  g. The result showed that the use of stingray and trash fish as feed gave no significant difference ( $p>0.05$ ) on the weight of mud crab after 30 days fattening period. In addition, the specific growth rate of treatment 1 and treatment 2 were  $0.25 \pm 0.20\%$  day<sup>-1</sup> and  $-0.70 \pm 0.27\%$  day<sup>-1</sup> respectively. During the experiment, some uncontrollable factors were encountered that may have influenced the outcome, such as cheliped disintegration, which resulted in a loss of moisture content and aqueous nutrient, which reduces crab weight. On the other hand, the fishermen who benefited from the technology were convinced that it was feasible and might increase their income.

**Keywords:** Fattening, Mud crab, Modified plastic cage.

## Embryonic and Larval Development in the European Eel (*Anguilla anguilla* L. 1758) During its Reproduction Efforts in Türkiye

Tuesday, 25<sup>th</sup> October – 15:15 - Main Conference Hall – Oral

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Burak Evren İNANAN<sup>2</sup>, Ahmet MEFUT<sup>1</sup>, Hüseyin SEVGİLİ<sup>3</sup>, Mahir  
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European eel (*Anguilla anguilla* L. 1758) has been assessed for the International Union for Conservation of Nature's Red List of Threatened Species and listed as critically endangered. Besides its ecological importance, European eel has economic importance. Several attempts to produce this species in captivity have been reported from many countries while no efforts for its production have been made in Turkey up to the present.

The fish were caught from the wild for gamete samplings. A total of 54 silver female European eels during the four sampling years (19 November 2017, 11 individuals in November 2018, 13 individuals in October 2019 and 11 individuals in November 2020) were caught from Demre Çayağzı Creek in Antalya and Bafa Lagoon in İzmir. After transfer to the hatchery facility, the fish were stocked in 2 tones tanks. Over the study period, water salinity and temperature were 38 ‰ and 20 °C respectively while photoperiod regime was 10 h light and 14 h dark. Carp pituitary extract was injected weekly at doses of 20 mg/kg and eggs were sampled in March for each sampling year. The expected weight gain in the females due to increase in egg mass occurred at 16<sup>th</sup> week in the first sampling year. Eggs were obtained by hand-stripping and spontaneous spawning. Surviving eggs were sampled from only one female in the first year and used for artificial fertilization. After a successful fertilization, it was observed that fertilized eggs had completed 16 cell divisions, but no progress was observed onwards. In the second sampling year, the expected weight gain in the females occurred at 19<sup>th</sup> week and biopsy samples were taken under anesthesia to define egg maturational stages. Diameter of these eggs was about 750-900 µm, and their cytoplasm were very transparent, the oil droplets could be counted. A stimulating hormone was injected and the fish spawn spontaneously. Approximately 500 g of fertilized eggs were obtained, and then their

embryonic and larval developments were monitored. The diameter of fertilized eggs ranged from 946 to 1242  $\mu\text{m}$ . newly hatched larvae were around 2500  $\mu\text{m}$  length. The larvae reached around 4600  $\mu\text{m}$  on 4<sup>th</sup> day after the hatching. The larvae survived for only 6 days in the second sampling year. Although around 394 g fertilized eggs were obtained with spontaneous spawning in the third sampling year, all embryos died within 2 days. In the fourth sampling year, female and male bloodstocks were subjected to the hormonal treatment, hereby 383 g of fertilized eggs in total were obtained. Both the fertilized eggs and larvae have been administered antibiotic treatment; these larvae were achieved to survive for only 13 days.

**Acknowledgment:** This study was conducted at the Beymelek Unit of Mediterranean Fisheries Research Production and Training Institute, Turkey, with a support of the project titled “Investigations of Production Possibilities of European eel under Controlled Conditions” funded by Republic of Turkey Ministry of Agriculture and Forestry General Directorate of Agricultural Research and Policy.

**Keywords:** European eel, hormonal induction, egg, larvae.

## Different Salinity Ratios' Impacts on Tub Gurnard (*Chelidonichthys lucerna*, Linnaeus 1758) Sperm and Egg

Tuesday, 25<sup>th</sup> October – 15:30 - Main Conference Hall – Oral

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In terms of aquaculture, tub gurnard is one of the species that has potential. Using various salinity levels (‰18, ‰23, ‰28, ‰33, ‰38, ‰43 ve ‰48), experiments on sperm features and motility, egg swim capability, and fertilization were conducted on this species, which has a high economic importance in aquaculture. When the sperm parameters were evaluated, the average amount of sperm was  $21.95 \pm 6.64$  mL, sperm density was  $4.45 \pm 0.07 \times 10^9$ /mL, pH:  $7.1 \pm 0.14$ , spermatocrit ratio was calculated as  $93.5 \pm 0.95\%$ . Depending on the increase in salinity, an increase in the percentage of motility was also observed. The motility was determined as 3.13% in the solution containing ‰10 NaCl, and as 6.24% in the solution containing ‰15 NaCl. The initial salinity value where the motility increased by more than 90% was found to be ‰28. The egg measures  $1183.5 \pm 34.61$  µm and the oil drop measures  $265.84 \pm 14.8$  µm. It has been observed that tub gurnard eggs cannot swim in the Black Sea salinity (‰18), but they can swim in salinities of ‰28 and above. Although fertilization occurred at all salinity levels tested, there were substantial disparities in fertilization rates. As a result, the best fertilization rate was obtained at salinity values of ‰ 28-33 (82.1%-85.2%), while the lowest fertilization rate was obtained at salinity of ‰ 18 (43.6%). At the end of the study, it was determined that the salinity values, where sperm motility and fertilization rate were high, were between ‰28-38.

**Keywords:** *Chelidonichthys lucerna*, tub gurnard, sperm kinematics, fish egg, fertilization, salinity.

**Biomass and abundance indices and length-weight relationships of thornback ray (*Raja clavata*, Linnaeus, 1758) estimated by a demersal trawl survey in Bulgarian Black Sea waters in autumn 2020**

**Tuesday, 25<sup>th</sup> October – 16:00 - Main Conference Hall – Oral - Online**

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This study provides information about the abundance and biomass indices of thornback ray, estimated through a scientific demersal trawl survey carried out in Bulgarian Black Sea waters during the autumn of 2020. The survey encompassed the territorial waters between Durankulak (north) and Ahtopol (south) within the 100-meter isobath and method of “swept area” was used for the calculation of biomass/abundance indices per depth stratum. The thornback rays stock biomass was assessed at 1187.89 tons, with a relative abundance of 519 606 individuals. Additionally, the exploited biomass was interpolated into 0.5° latitude/longitude grid cells (given as the average of the standardized catch per unit area, CUPA kg.km<sup>-2</sup>) and the abundance of the two species (given as the average of the standardized numbers of individuals, N.km<sup>-2</sup>) using R script (version 0.2.01) in RoME and Biondex (version 3.1). The thornback rays were present at depths of 43 - 85 m, with an average biomass of 122.9 kg.km<sup>-2</sup> and an abundance of 55 ind.km<sup>-2</sup>. The distribution of both, the maximum biomass and abundance of thornback rays followed a similar spatial model, as the highest average values of biomass of the species varied between 126.53 - 218.85 kg.km<sup>-2</sup>, with those of the abundance were of 51.7 - 107 ind.km<sup>-2</sup>. The length-weight relationships for this species were established based on the combined samples from the two sexes and separately for female and male individuals, allowing a better understanding of the growth patterns.

**Keywords:** thornback ray, biological parameters, biomass indexes and LWRs (length-weight relationships).

## First Siberian Sturgeon Production in Türkiye and the Effect of Different Feeds on Growth Performance and Survival Rates of Siberian Sturgeon Larvae

Tuesday, 25<sup>th</sup> October – 16:15 - Main Conference Hall – Oral

**Tuna ÖZCELEP<sup>1,\*</sup>, İrfan Selçuk YAZICI<sup>1</sup>, Bilal AKBULUT<sup>1</sup>, Recep PARLAK<sup>1</sup>, Hasan ERGÜN<sup>1</sup>**

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Siberian sturgeon is one of the few sturgeon species cultivated worldwide for its meat and particularly its caviar. The main reason why it is preferred is that it produces caviar earlier than other sturgeon species. The first production of fry from Siberian sturgeon in Turkey was carried out in 2020 by Trabzon Central Fisheries Research Institute. The aim of this study is to determine the growth performance and survival rates of larvae produced from broodstock fish in Trabzon Central Fisheries Research Institute and fed with different diet compositions. In this study conducted in 2022, 3 different diets were used: commercial fish feed (CFF), CFF + artemia nauplii (AN) and CFF + artemia cyst (AC). In the study, 12000 larvae were fed with diets determined in fiberglass aquaculture tanks (1x1x0.5 m) in the recirculating aquaculture system (RAS), at appropriate stocking density and constant water quality criteria, for 15 days from the consumption of the yolk-sac. Fish were fed every 2 hours at fish biomass rates ranging from 60% to 3% per day. Weight gains occurred, from largest to smallest, in the GM+AN, GL+AK and GL groups, respectively and the survival rates were in the same order.

**Keywords:** Siberian sturgeon, diet, feeding, growth performance, survival rate.

## Comparison of Fatty Acid Profiles of Black Sea Salmon (*Salmo labrax*, PALLAS 1814) Caught from Haldizen and Fırtına Streams

Tuesday, 25<sup>th</sup> October – 16:30 - Main Conference Hall – Oral

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This study was carried out to determine the fatty acid profile of wild Black Sea salmon (*Salmo labrax*), which has been adapted to the culture conditions and whose aquaculture has become widespread in the Eastern Black Sea region, and to provide data for the feed formulation program. In this context, fatty acid analysis was carried out from samples taken from muscle, liver and gonad tissues of fish caught from Haldizen and Fırtına creeks, where Black Sea salmon is widely distributed between Trabzon-Rize borders. The results obtained were used to create feed formulations for the feeding of broodstock adapted to the culture condition and the fry obtained from them. It was determined that palmitic acid (PA, 16:0) was the dominant fatty acid in the fatty acid analysis of the Black Sea salmon broodstock' muscles caught from the Fırtına and Haldizen streams, and there was no statistical difference in terms of this fatty acid between the creeks ( $p>0.05$ ). In terms of total saturated fatty acids (SFA), no statistical difference was found in the muscles of the fish taken from both rivers ( $p>0.05$ ). However, when polyunsaturated fatty acid (PUFA) and docosahexaenoic fatty acid (DHA, 22:6n-3), which is thought to have a significant effect on gonad development during the reproductive period of fish, was examined in muscle tissues, it was  $14.09\pm4.74\%$  in fish caught from Fırtına Creek. While it was found to be  $5.17\pm0.63\%$  in individuals caught from Haldizen stream ( $p<0.05$ ). On the other hand, it was determined that this fatty acid amount was not different in the gonad tissues of fish compared to  $p>0.05$ . The formation of feed formulations by taking into account the tissue fatty acid profiles of wild Black Sea salmon individuals will make a significant contribution to the profitable production of the species.

**Keywords:** Black Sea Salmon, fatty acid, nutrition, feed.



## Investigation of Novel Anesthetic Compounds in Fish

Tuesday, 25<sup>th</sup> October – 16:45 - Main Conference Hall – Oral

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Many types of anesthetics are widely used to reduce stress responses and minimize physical injury to fish in aquaculture and scientific research. The most commonly used substances are tricaine and benzocaine, which act as local anesthetics by blocking voltage-dependent sodium channels in cells, due to the high cost and difficulty of supplying these therapeutics from abroad the demand for the discovery of alternative anesthetic substances. Plants classified as medicinal and aromatic plants (TAB) and extracts obtained from these plants have been used in various fields for therapeutic purposes for many years. There is an increasing interest in studies reporting that the anesthetic properties of essential oils obtained from plants such as clove, mint, lavender, thyme, and rosemary have been used on various fish species, and new ones are added every day. However, due to the low reliability of these compounds, new anesthetic agents are needed in Aquaculture and connected research. Within the scope of the study, the potential of immobilizing fish was tested for 2 compounds (Trimebutin and *Capparis ovata* extract), which have a possible local anesthetic effect by blocking sodium channels. In the experiment Rainbow trout (*Oncorhynchus mykiss*) weighing about 5-6 grams were used. Rainbow trout is a type of bony fish widely cultivated worldwide for human consumption, and it can adapt to wide environmental conditions. In the experiment, the trial solution was prepared by adding at least 5 different amounts of potential anesthetic products to 5-liter containers containing 1 liter of water. Fish were individually placed in each solution and observed. The duration of the immobilizing was recorded. The fish that remained completely motionless was taken to a constantly ventilated tank, their behavior was observed, and the transition times to normal swimming were recorded. For each potential product and dose, fish (at least 30 fish) were collected in a tank and monitored for 24 hours, recording abnormal behavior and mortality. Experimental solutions were changed every 10 fish. The duration of immobility, then normal swimming behavior, and survival rates of the fish were analyzed by multiple comparison tests. In the experiment, no change was observed in the behavior of the fish exposed to the maximum dose of 2 grams/Liter of *Capparis ovata* extract within 30 minutes. In fish

exposed to the Trimebutin compound, it was observed that fish exposed to 50 mg/Liter concentration started to lose their balance after 15 minutes. It was observed that fish exposed to 100 mg/Liter Trimebutin concentration lost their balance within 1 minute and remained completely motionless within 3 minutes, which is the ideal time for immobilizing fish. In conclusion, it is necessary to conduct more research on plant-based anesthetic substances in the aquaculture sector and to expand the use of these herbal substances in fish.

Acknowledgment. This study was conducted with the financial support of SUMAE and KTÜ BAP01 “Development Of Novel Anesthetic Compounds In Fisheries Research And Farming” project.

**Keywords:** Anesthesia, Rainbow trout, *Capparis ovata*, Trimebutin, Effective concentration

## Reproductive performance of Black Sea salmon (*Salmo labrax* Pallas, 1814) fed with diets containing different lipid levels

Tuesday, 25<sup>th</sup> October – 16:45 - Main Conference Hall – Oral

**Eyüp ÇAKMAK<sup>1,\*</sup>, Osman Tolga ÖZEL<sup>1</sup>, Nilgün AKSUNGUR<sup>2</sup>, Muharrem AKSUNGUR<sup>2</sup>, Hasan ERGÜN<sup>1</sup>, Zehra Duygu DÜZGÜNEŞ<sup>3</sup>, Muhammed Doğan ÖZDEMİR<sup>1</sup>**

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**Introduction.** Special feeding programs applied during egg maturation and spawning season are of great importance in the nutrition of breeding fish. The purpose of feeding outside the spawning season is to keep the broodstock fish healthy until gamete development begins for the next breeding season. The importance of polyunsaturated fatty acids in diets in the development of eggs and larvae is great. In this study, we aimed to the effect of different lipid levels on reproduction in Black Sea salmon broodstock.

**Materials and Methods.** The present study has been conducted in cooperation with Karsusan Trout Farm under the supervision of Central Fisheries Research Institute, Turkey. A total number of 96 third fillial generation of Black Sea salmon broodstock were divided into 3 groups of 32 fish species, each group containing 16 male and 16 female. Fish were individually marked with PIT tag (12 mm 134 KHz), and randomly subdivided to 2x2 m fiberglass tanks. Fish were fed by hand until satiation twice a day for a period of three month starting from September to December with diets containing 15, 20, and 25% of lipid. Protein levels in all diets were kept at about 46.5%. The amount of water in the tanks was adjusted to be 3m<sup>3</sup> and the water change was be 20 times/day. During the trial, the average water temperature was measured as 15.1±2.4°C for September 2011, 11.1±2.8°C for October and 6.6±3.4°C for November. At the end of the trial, broodstock specimens prepared using 50 ppm benzocaine (Oswald, 1978), a standardized trout stripping protocol modified from Billard, 1992 was followed to obtain eggs and sperms, and the eggs in each group were fertilized with the sperms collected from the same group. Egg diameter was measured by using a method of measuring fish eggs (Von Bayer, 1910). Fecundity was determined by using method of Vladykov (2011).

Results. Reproductive performance of Black Sea salmon was affected by dietary treatments ( $p < 0.05$ ). The number of eggs, the total weight of eggs, egg diameter, fecundity, mortality and malformation was not significantly differentiated between treatments. The fertilization rate was affected by dietary treatments ( $p = 0.035$ ). The highest fertilization rate (98.92%) was seen in fish fed with diet containing 20% lipid. This was followed by 25% lipid (98.03%). Although no statistical differences, feeding with 25 % lipid tended to have higher fecundity and egg number.

Conclusion. When the results obtained for the determination of reproductive performance (except fertilization rate) of Black Sea salmon broodstock are evaluated, levels containing 15%, 20% and 25% lipid had similar results with each other. However, in terms of fertilization rate, fecundity, number of eggs and larval mortality, we can say that the diets containing 20% and 25% lipid have better performance. Narrower ( $< 15\%$ ) and wider ( $> 25\%$ ) ranges need to be investigated to gain more comprehensive information on the lipid requirement in the reproductive stage of this species.

Acknowledgments. This research was done as a preliminary study for the project named “The Determination of Nutritional Requirements in Black sea Trout (*Salmo trutta labrax*)” supported by General Directorate of Agricultural Research and Policies. We thank to Alaattin YIGIT for technical assistance.

**Keywords:** Black Sea Trout, reproductive performance, nutrition, lipid.

## A Possible Biomass Contribution to Fauna of Finike Seamounts by Terrestrial Insects

Wednesday, 26<sup>th</sup> October – 08:30 - Main Conference Hall – Oral

**Fatih DİKMEN<sup>1,\*</sup>, İrem KISMET<sup>1</sup>**

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Insects are a kind of special animal group that contains the largest amount of biodiversity on earth. Their majority presence is known at terrestrial habitats but they may occasionally have encountered in samples taken from the sea. Many of the tiny insects can be drifted away even by weak breezes and they may travel hundreds of kilometers and then they may have been blown into marine habitats. In this study the insects were caught from the open sea, from Finike Seamounts Special Environment Protected Area (SEPA). Field studies were conducted in May and September at 2021. Among 27 samplings, eight of them were containing insect specimens. Samples were collected by plankton traps. The most encountered insect groups were Homoptera members (some aphids), Coleoptera members (some carabids), Lepidoptera members, Diptera members (some culicids) and Hymenoptera members. These specimens found were not aquatic insects but terrestrial and were considered as specimens that were accidentally drifted away into the sea. This causes us to evaluate the possibility that they may have a potential to make a biomass contribution to the marine ecosystem. Further investigation of the subject and revealing possible insect biomass contributions in the sea constitute an important horizon for future studies.

Acknowledgment. We are thankful to Dr. Onur Gönülal for obtaining the samples.

**Keywords:** Marine insects, Diptera, Homoptera, Biodiversity, Finike, SEPA, plankton trap.

## Otolith Shape Analysis of Anchovy (*Engraulis encrasicolus*) in the Black Sea coast of Turkey

Wednesday, 26<sup>th</sup> October – 08:45 - Main Conference Hall – Oral

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Otoliths are used in the stock separation method to clarify the geographical boundaries between stocks and determine the composition of mixed stocks. Anchovy otoliths were studied in 8 stations (İğneada, Marmara, Zonguldak, Sinop, Terme-Samsun, Trabzon, Pazar-Rize, Hopa-Artvin) during the 2012-2014 fishing season. In this study, photographing, morphological measurements, and analysis calculations of 400 anchovy otoliths were made. LAS Image Analysis program v3.8 was used with the MZ75 Leica imaging system to obtain data for biometric measurements and shape analysis. Otolith shape indices such as: form factor (FF), roundness (RD) and aspect ratio (AR) were determined and calculated for the definition of otolith shape from the measurement data obtained (Ponton, 2006; Zorica et al., 2010). The change in AR value on anchovy otoliths obtained from the eight stations along the Black Sea coast of Turkey was determined according to age and length group. Otolith shape analyzes were performed using 0-age ( $TL \leq 8.9$  cm and  $9.00 \leq TL \leq 10.40$  cm length group) and 1-age ( $11.00 \leq TL \leq 11.5$  cm length group). When the change in AR value used in the separation of stocks was evaluated by fixing length groups and age groups; the lowest value was found in 0-age group ( $TL \leq 8.9$  cm,  $mean \pm SE$ ;  $1.91 \pm 0.036$ ) in Pazar-Rize and as the highest AR value was in Sinop ( $2.05 \pm 0.015$ ). For the  $9.00 \leq TL \leq 10.40$  cm length group, the lowest value was in Trabzon ( $1.99 \pm 0.023$ ), and the highest value was in Hopa-Artvin ( $mean = 2.08 \pm 0.026$ ). It was observed that in 1-age group ( $11.00 \leq TL \leq 11.5$  cm) the lowest value was in Terme-Samsun ( $mean = 2.01 \pm 0.042$ ), the highest value was in Pazar-Rize ( $mean = 2.10 \pm 0.038$ ). In the clustering analysis performed on the AR value obtained on the otoliths of anchovies with  $TL \leq 8.9$  cm, it was observed that Zonguldak, Sinop and Terme-Samsun formed a group, while Trabzon, Pazar-Rize and Hopa-Artvin formed another group by showing similarities among themselves. However, the results of measurements (AR) and analysis showed that the 0-age group ( $9.00 \leq TL \leq 10.40$  cm) of Pazar-Rize anchovy otoliths differed from the other stations' otoliths. In the AR clustering analysis of 1-age group ( $11.00 \leq TL \leq 11.5$  cm) Zonguldak anchovy otoliths were found to be different from the others.

**Acknowledgment.** This study was carried out under Project No: TÜBİTAK 110G124.

**Keywords:** Black sea, anchovy, otolith, shape analysis.

# Population Structure of Mediterranean Horse Mackerel in The Marine Waters of Türkiye as Determined by Morphological Markers

Wednesday, 26<sup>th</sup> October – 09:00 - Main Conference Hall – Oral

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The stock-based strategy in fisheries management has greatly backup fish stock to naturally replenish, ensuring their sustainable levels of abundance in the future. On the contrary, applying the same management strategies to multiple distinct fish stocks inevitably leads to overfishing and often results in the collapse of the weaker components. Thus, stock identification helps determine the origin and proportion of a species' subpopulations (stocks) that can eventually enhance cross-area fisheries management and developing sustainable fisheries strategies. However, commercial fishers are typically unable to differentiate between different stocks of the same species. Thus, the authority responsible for fisheries management should take samples from commercial catches (or landings) in the mixing areas (where multiple stocks of the same species may be found) to identify which stock has been fished and to assess the contribution of each stock – this information would be used in monitoring quota to prevent overfishing of a specific fish stock. In this study, we aim to identify different stocks of the Mediterranean horse mackerel (*Trachurus mediterraneus*) in the Black Sea (26.5° E – 39.9° E, 38.7° N – 42.1° N) and adjacent regions, viz., the Sea of Marmara, the Aegean Sea and Eastern Mediterranean Seas using morphological markers, viz., sagitta otoliths, and body shape analyses. Shape of sagittal otoliths was assessed with Elliptic Fourier analysis as well as shape indices, while geometric morphometrics analysis was used to evaluate the body shape of Mediterranean horse mackerel. The statistical analyses of the data based on multivariate and univariate analyses of variance, principal component analysis, and discriminant function suggested a restricted migration of the Mediterranean horse mackerel among the adjacent seas, demonstrating the presence of multiple isolated stocks of this fish. In sum, the obtained results support the existence of distinct stocks of Mediterranean horse mackerel, which should be taken into consideration for the effective management of this pelagic fish species in Turkish marine waters.

**Keywords:** Climate change; Elliptic Fourier analyses; Geometric morphometrics; Marine Functional Connectivity (MFC); Stock discrimination.

## Stakeholders' Perspectives on the Management Measures in Rapa Whelk Fisheries in the Black Sea Turkish Coast

Wednesday, 26th October – 09:15 - Main Conference Hall – Oral

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It has been shown in previous studies that complex problems with ecology, economics, social, ethical, and management aspects are effective in not achieving sufficient success in fisheries resource management worldwide. Similar problems also arise in the management of the Rapa whelk (*Rapana venosa*), which has become increasingly important for commercial fishing in the Black Sea for nearly 40 years. The Rapa whelk, which entered the Black Sea as an invader, has become a commercial stock and has brought many problems in its management since the 1980s. In the first ten years, the basic principle was determined to Rapa whelk all of them and clear the ecosystem from them. However, starting from the second decade, the average size of individuals with large sizes started to decrease due to the lack of nutrients and the effect of fishing. Therefore, there has been a relative decrease in the profitability of fishers fishing for snails. With the decline in profitability, some of the processing plants were closed. Despite this, Rapa whelk still maintains its importance as a commercial species in the Black Sea. Despite the problems in the process, Rapa whelk still has a market value of 5.7 million dollars and is a source of income for more than 700 fishers. In addition, some measures taken for fisheries management, such as fishing gear and fishing time restrictions, pose a problem for fishers. This research aimed to get a detailed idea about the views of the stakeholders of the Rapa whelk sector and to develop concrete and applicable suggestions for the sustainability of the sector. For this, first of all, all stakeholder groups were brought together and their opinions were taken. Afterward, the management measure suggestions collected from the group were evaluated by everyone through questionnaires. When the general opinions of the stakeholders were evaluated, it was seen that most of the beam trawlers argued that legal restrictions should be softened to be able to fish more while academicians and representatives of environmental organizations stated that environmentally friendly fishing gear should be



designed and used to protect the marine ecosystem. The policymakers participating in the workshop think that some arrangements can be made in the current legislation, but there is no need for radical changes. Industry sector stakeholders participating in the workshop, on the other hand, think that measures that restrict their production, such as quota limitation, are not appropriate. In summary, in the study, alternative management measures were examined and their possible effects evaluated. As a result of this study, recommendations were made for sustainable fishing of Rapa whelk.

**Keywords:** *Rapana venosa*, fisheries stakeholders, fisheries management, fishers.

# Integrated GIS Mapping and Public Perception on Coastal Marine Protected Areas Determination in Trabzon Coast, SE Black Sea

Wednesday, 26<sup>th</sup> October – 09:30 - Main Conference Hall – Oral

**Neira Purwanty ISMAIL<sup>1\*</sup>, Coşkun ERÜZ<sup>1</sup>**

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**Introduction.** In recent decades, the Black Sea has undergone human pressure such as overfishing, coastal reclamation, and pollution (Erüz et al., 2022). Marine Protected Areas (MPA) are considered as an effective tool for marine resource management (Bonanno, 2022). This study purposes to determine the coastal and marine protected areas on the Trabzon coast, Southeast Black Sea.

**Materials and Methods.** In this study, the Balıklı-Sürmene and Çamburnu-Sürmene of Trabzon coasts were selected as pilot project to determine coastal and marine protected area in the Black Sea. The GIS multi-criteria analysis and public perception have been integrated to rank the most suitable to the low suitable coastal and marine protected areas. In this study, spatial analysis was based on the ecological, socio-cultural, and economic features of the study area. Opinions of the people of Trabzon were collected using survey method.

**Results and Discussions.** Coastal and marine protected areas on the Trabzon coast; Çamburnu-Sürmene then Balıklı-Sürmene respectively rank among the most suitable to low suitable. There is similarity in ecological, socio-cultural, and economic characteristics among the coastal area. Coastal profile, pollution threat, fisheries importance, and tourism values determine suitability. The spatial analysis results are in accordance with the questionnaire results participated by locals. Most participants agreed on the idea of coastal and marine protected areas in the region. The present study revealed that the Trabzon coast requires conservation and protection due to increasing human activities (pressure) in the area. The demand for MPA in this region has become urgent as the decline in its coastal natural resources which linked to long-term coastal reclamation in the area.

**Acknowledgment.** The author would like to thank all the questionnaire volunteers also Mr. Furkan MANİ for initial data collections.

**Keywords:** biodiversity, marine protected areas, GIS, public participation, Black Sea.

## Rewind – A Natural & Scalable Solution for CO<sub>2</sub> Removal

Wednesday, 26<sup>th</sup> October – 09:45 - Main Conference Hall – Oral

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Climate change is an existential risk for mankind and for many natural ecosystems, and the time to mitigate devastating consequences is running out. The need to decarbonize all sectors of the economy is clear and urgent, but also insufficient. The pathway suggested by the IPCC to limit global warming to 1.5°C requires us to remove 10 billion tons of CO<sub>2</sub> from the air every year, by 2050. We (the Rewind Group) believe that although there are many ways to remove atmospheric carbon, biomass sequestration is the safest and most efficient Carbon Dioxide Removal (CDR) method. Rewind is a group of marine ecologists and engineers that is developing a CO<sub>2</sub> removal method which mimics the way that fossil fuels were created: storing biomass (plants, seaweed, organic matter) in deep, anoxic conditions for hundreds or thousands of years. The method removes CO<sub>2</sub> from the atmosphere by collecting biomass, which has captured CO<sub>2</sub> during photosynthesis, and relocating it to the deep, anoxic bottom of the Black Sea. Our thesis is that the particulate carbon in the deposited biomass will remain on the seafloor for centuries if not millennia and in this manner, it cannot become oxidized and release CO<sub>2</sub> to the atmosphere. Nature already sequesters large amounts of organic carbon annually via rivers that spill into the Black Sea, where this carbon is deposited to the seafloor. To demonstrate that the Rewind concept really removes CO<sub>2</sub> and does not harm the environment, we have launched a series of scientific experiments. These experiments take place in the laboratory, transition through a controlled, small scale experiment, carried out in the natural environment, and will eventually progress to a large-scale experiment in the Black Sea. Initial findings have shown that organic material placed in anoxic conditions in Israel and in Germany decomposes more slowly than identical material placed in oxygenated waters. Moreover, preliminary results of small-scale experiments carried out in deep, anoxic Black Sea waters indicate that there is no loss of weight when comparing different types of biomass.

**Keywords:** Carbon Sequestration, Black Sea, Biomass, Climate Change, Anoxia.

## Assessment of School Structures and Behaviors of Small Pelagics Depending Upon Water Temperature by Hydro-Acoustic Method in South Eastern Black Sea

Wednesday, 26<sup>th</sup> October – 10:00 - Main Conference Hall – Oral

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Effects of climate on temperature impact marine pelagic systems very strongly through alterations of atmospheric conditions, oceanic currents, upwelling's and etc... Ocean currents are affected by the salinity through evaporation or precipitation as a result of climate change. Depending on the alterations of thermal regime, oxygen concentration is also influenced by the climate. This daisy chain affects macro and micro –nutrients by upwelling, or discharges of rivers. Therefore, climatic change, whether natural or brought on by human activity, can modify the regional ecological circumstances of pelagic habitats, affecting the diversity of species and the make-up of biological communities. Every species has a distinct ecological niche that encompasses all of the environmental elements that allow it to successfully complete its life cycle. Acclimatization, which involves changing behavior to take advantage of environmental conditions that are closest to the species' ecological optimum and then adjusting physiologically if behavioral adjustment is insufficient, is likely to be the first response to unfavorable environmental conditions. The use of hydroacoustic records to monitor the consequences of environmental change may be beneficial. In this regard, hydroacoustic surveys were conducted for years in South Eastern Black Sea to monitor small pelagics in terms of especially school distribution and population dynamics. Due to the collected massive data for years, comparative results came up regarding school structures and behaviors of the species. In this study, school structure and behaviors of *Trachurus mediterraneus* (Steindachner, 1868) and anchovy (*Engraulis encrasicolus*) commercially important species in the Black sea, were assessed in the year 2018 in terms of distribution along the water column and the relationship of their behaviors with water temperature was discussed. Besides, migration behavior of the both species depending on seasonal cooling temperature was presented. According to the results, horse mackerel stocks were nearby the coast and anchovy distributed in more distant areas. Horse mackerel was close to the seabed, anchovy was in the water column, and in both species tended to stay above the warm thermocline layer. It has been observed that both species tended to migrate to the warmest place they could find depending on the cooling of the sea water in this region.

**Keywords:** Hydro-acoustic, *Trachurus mediterraneus* (Steindachner, 1868), *Engraulis encrasicolus*, water temperature, migration behavior.

## The Importance of Sprat in terms of Food Dynamics in the Black Sea Ecosystem

Wednesday, 26<sup>th</sup> October – 10:15 - Main Conference Hall – Oral

**Mustafa ZENGİN<sup>1,\*</sup>**

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Sprat is constituting one of the three most important fish species of the small pelagic fish fauna in the Black Sea ecosystem. The sprat population, which is distributed in the Black Sea littoral of Turkey, was not fished commercially until the early 2000s. However, since the end of the 1980s, it has come to the fore as an important alternative catch by trawlers against the commercial demersal fish stocks that collapsed in the Central Black Sea (Samsun Self Region). Especially, besides anchovy, it has gained great importance as an important feed source for the fish meal-oil industry in the region. Since the beginning of the 2000s, when commercial fishing began, sprat fisheries has increased gradually and the catch amount has reached 80 thousand tons in about 20 years. Trawl fishermen, characterized by bottom trawling in the Samsun Shelf Region, have played an important driving role in the development of this sector by switching to sprat fisheries in this process. Sprat caught by pelagic midwater trawling has gained a more advantageous position economically compared to traditional bottom trawling and sea snail/beam trawling, which is older in the region during the same period. However, sprat is one of the most basic key species of the food chain in the Black Sea ecosystem, along with two other small pelagic species anchovy and horse mackerel. Two important commercial fish species, especially distributed in the Black Sea benthopelagic, constitute the main/primary food source of whiting and turbot. Scientific research has revealed that both species have a feeding strategy largely dependent on sprat in the pelagic food chain. On the other hand, one of the important reasons for the decrease in the turbot and whiting stocks in parallel with the increase in sprat fishing is these extreme breaks in the food dynamics. This decline is still increasing. The whiting and sprat share the same habitats in the littoral of the Black Sea. Both species predominantly have an interdependent vertical migration strategy below the thermocline layer throughout the year. The main food source of the turbot population also consists of whiting. Sprat fishing with midwater trawl continues until May 15th, unlike bottom trawl fishing. Especially with an increasing fishing effort in the Samsun Self Region, catching pressure is created on the young turbot populations migrating in the near coastal waters. This pressure also has a negative effect on other benthic, benthopelagic and pelagic fish fauna in the same ecosystem. In this respect, a new fisheries management model should be established in order to eliminate the possible effects of sprat fishing in the Central Black Sea littoral on possible breaks in the food chain and on the food dynamics of other important species. In addition to temporal measures, more rational and radical decisions should be taken for optimum sustainability of the sprat population.

**Keywords:** South-astern Black Sea, *Spratus sapratus*, food dynamics, overfishing, mid-water trawling.

## A New Ostracod (Crustacea) Species from Antarctica

Wednesday, 26<sup>th</sup> October – 10:30 - Main Conference Hall – Oral - Online

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A new ostracod species *Xestoleberis nanseniensis* n. sp. is encountered from the sixth Turkish Antarctica Expedition (TAE-6). The new species shows the following different characteristics from its congeners: carapace surface with fine long striae, terminal segment of the first antenna with three short setae, second segment of the second antenna with one short and one long claw-like seta, second segments of the legs (T1-3) with a short and smooth well-developed seta. Although the new species was found from Nansen Island (Western Antarctica), it is a marine ostracod. Implication of its presence on the island was discussed.

**Keywords:** Antarctica, Nansen Island, TAE-6, first reports, taxonomy

## Current Status of the Konya Closed Basin Endemic Fish Fauna

Wednesday, 26<sup>th</sup> October – 10:45 - Main Conference Hall – Oral

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The Konya Closed Basin is located in the central Anatolia plateau, and the basin can be classified as a semi-arid region with a high risk of desertification. Although the freshwater potential of the basin is low, KCB has the greatest fish endemism compared to the other basins of Turkey. Anthropogenic pressures on freshwater habitats are constantly growing. Major threats to these habitats can be classified as pollution, habitat degradation, flow modification, development of dams, and species invasions. In addition to these, another emerging problem is climate change, which threatens the anthropogenic use of water as well as biodiversity. These threats are unequally distributed over the KCB, with some threats being particularly intense in some parts of the region. Our goal in this study is to collect data from the literature and field studies in order to provide an updated review of the current status of endemic fish species in the KCB and its main lakes and to identify major threats affecting endemic fish fauna. There have been 38 fish species reported from KCB, 28 of which are endemic. Among endemic species of KCB, 16 species are categorized as threatened with extinction and four of these species are Critically Endangered (CR). The distribution ranges of species that are considered to be threatened are extremely constrained. These small populations are susceptible to even relatively minor environmental stressors, which can have a significant effect on their entire population and, consequently, their chances of surviving.

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**Keywords:** Konya Closed Basin, fish fauna, threats, endemism.

## Potentially Toxic and/or Harmful Phytoplankton Observed at An Algerian Shellfish Farm: CULTMARE- Tipaza

Wednesday, 26<sup>th</sup> October – 11:00 - Main Conference Hall – Oral

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The inventory as well as the temporal dynamics of the possibly potentially toxic and/or harmful phytoplankton population at the Algerian shellfish farm "CULTMARE" (Tipaza) for the year 2021 were studied. Temperature and salinity of the five locations varied according to season. Qualitative and quantitative analyses of phytoplankton populations indicated that there were 77 taxa. One species (genus *Pseudo-nitzschia*) was in the class of potentially toxic diatoms, and six species (*Dinophysis*, *Alexandrium*, *Ostreopsis*, *Prorocentrum*, *Cyclotella*, and *Gambierdiscus*) were in the class of potentially toxic dinoflagellates.

Other potentially toxic dinoflagellates were found, including *Ceratium*, *Scrippsiella*, *Karenia*, *Prorocentrum*, *Gyrodinium*, *Akashiwo*, *Gonyaulax*, and *Noctiluca*. The diatoms were represented by the following genera: *Cylindrotheca*, *Rhizosolenia*, *Thalassiosira*, *Chaetoceros*, and *Leptocylindrus*. These species have never been associated with phytoplankton blooms in this area. The examination of mussel and oyster intervalvular fluids revealed the presence of 23 phytoplanktonic species divided into two groups, with diatoms outnumbering dinoflagellates.

Physicochemical parameters influenced the succession of phytoplankton communities. Small fluctuations in nutrient salts at the farm level, particularly nitrogen levels, reduce the risk of eutrophication considerably. We found two types of phytoplankton taxa: those that produce biotoxins; those that are toxic to humans through the food chain (6 species); and those that are harmful to marine wildlife (14 species). Nonetheless, the phytoplankton population never exceeded a total concentration of  $1.1.360 \times 10^3$  cells/l.

**Keywords:** Toxic phytoplankton, harmful phytoplankton, physico-chemical parameters, CULTMARE, Tipaza.



## Evaluation of Antibacterial Activity of Cultivated Caucasian Whortleberry (*Vaccinium arctostaphylos* L.) Against Fish Pathogens

Wednesday, 26<sup>th</sup> October – 11:15 - Main Conference Hall – Oral

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Bacterial diseases are one of the major factors hampering aquaculture sustainability. Antibiotics are the widespread treatment or prevention agents against infectious bacterial diseases in fish culture. However, due to the rising issue of antibiotic resistance brought about by the non-prudent use of antibiotics, sourcing environmentally benign alternatives, such as the use of herbal/medicinal plants, is now the center of attention of most researchers. Hence, in this study, a minimum inhibitory concentration (MIC) test by broth dilution method was performed to determine *in vitro* antibacterial activity of aqueous methanolic extract of cultivated Caucasian whortleberry (*Vaccinium arctostaphylos* L.) against different fish pathogens, i. e., *Yersinia ruckeri*, *Pseudomonas putida*, *P. luteola*, *Aeromonas salmonicida*, *A. hydrophila*, and *A. sobria*. Results revealed that the MIC values of used aqueous methanolic extract for *Y. ruckeri*, *P. putida*, *P. luteola*, *A. salmonicida*, and *A. hydrophila* were 8.75 mg mL<sup>-1</sup>, while *A. sobria* was found to be 2.19 mg mL<sup>-1</sup>. This study suggests the potential use of the medicinal plant *V. arctostaphylos* L. against all tested fish pathogens. However, to assess the usability of this plant, further *in vivo* studies should be carried out.

**Keywords:** Antibacterial activity, Bacterial diseases, Fish pathogens, Medicinal plant, *Vaccinium arctostaphylos* L.

## Detecting Toxic Species from Marine Mucilage through Digital Droplet PCR

Wednesday, 26<sup>th</sup> October – 11:30 - Main Conference Hall – Oral

Işılay ÇELİK<sup>1,2\*</sup>, Esra Mine ÜNAL<sup>1,2</sup>, Berkay GÜLEN<sup>2</sup>, Pelin TAŞ<sup>1,2</sup>, Emre KESKİN<sup>2</sup>

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A visible cluster of organic molecules with a viscous structure that is present in marine water is called marine mucilage. The Adriatic Sea, Tyrrhenian Sea, Mediterranean Sea, and Ionian Sea have all previously been noted to contain mucilage. Both abiotic and biotic mechanisms have an impact on how marine mucilage develops. The main abiotic factors include variations in water nutrient concentrations, anthropogenic effects, and climate, while biotic factors are microorganisms' reactions to these abiotic factors. To ascertain which microbial communities are abundant and to investigate potential marine diseases that impact practically all organisms, it is crucial to identify the mucilage composition. In our previous researches, we identified the composition of mucilage in terms of bacterial and eukaryotic organisms with the eDNA metabarcoding method. As a result, toxic species were detected. To investigate toxic species in complex environments, more sensitive and less expensive methods should be developed. We hypothesized that one of the most abundant and toxic genus and species in mucilage, *Alexandrium* and *Alexandrium margalefii*, could be detected using digital droplet PCR. Digital droplet PCR generates approximately 20.000 droplets with the input material so that a polymerase chain reaction occurs in each droplet. With this high throughput PCR, tolerance to the inhibitors can be increased while using a low DNA amount. In this research, we showed that toxic genera and species can be identified from dense and spotted environments by using specific designed primers and the ddPCR method. Acknowledgment. This study was supported by AgriGenomics Hub: Animal and Plant Genomics Research Innovation Center.

**Keywords:** Mucilage, ddPCR, *Alexandrium*.

## Biodiversity Assessment of Bird Species in Uyuz Lake Using Environmental DNA Metabarcoding

Wednesday, 26<sup>th</sup> October – 11:45 - Main Conference Hall – Oral

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Turkey is a bridge for two important bird migration routes: Europe-Africa and Africa-Asia. Identifying bird species (migratory and local) whose populations are declining on a global scale is very important for making an ecological assessment. Environmental DNA (eDNA) metabarcoding enables us to determine target species and the biodiversity of the sampled habitat without any contact at species level on the reference database scale. In this study, it was aimed to detect Aves class species by the eDNA metabarcoding method in Uyuz Lake, which is one of the protected wetlands in Turkey. Both water samples were taken and simultaneous bird observations were carried out when bird migration started and it is not intensive in March (daily sampling), when it is intensive in April (during the whole month) and in August (daily sampling). A total of 36 water samples obtained were filtered with a closed filtration system, and DNA extractions were carried out from eDNA samples. PCR amplifications were performed with universal primers specific to the Aves class and amplify a short region of the 12SrRNA gene. PCR products were pooled at an equal volume and divided into 2 libraries. All pools were purified and fragment sizes of PCR pools checked. Then PCR products were performed to adapter ligation and sequenced using paired-end amplicons of 150 base pairs length. The filtered sequences were matched with EMBL/NCBI reference databases for taxonomic assignment of the Aves class. As a result of matching with the reference database, 30 bird species were obtained. There are 13 species that have been seen, and 17 species that have not been seen but are likely to be seen in Konya and the area around it or that match the closest species because there isn't enough data in the reference data bases about the 12S gene region for bird species.

Acknowledgment. This study was supported by AgriGenomics Hub: Animal and Plant Genomics Research Innovation Center.

**Keywords:** eDNA, aquatic ecosystems, metabarcoding, species identification, migratory birds.

# A Roadmap and Key Issues for *De Novo* Chromosome-Scale Fish Genome Assembly: Current Challenges and Best-Practices

Wednesday, 26<sup>th</sup> October – 14:00 - Main Conference Hall – Oral

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With more than 27 000 species, teleost fishes are considered as largest and most diverse group of vertebrates and account for more than 99% of ray-finned fishes. The teleost fishes exhibit remarkable diversity in terms of morphology, physiology and adaptation. Although the sequencing of teleost genomes lags behind that of mammalian and insects, there is a continuous increase of *de novo* teleost genome studies because of significant progress in next-generation, third-generation sequencing technologies as well as scaffolding techniques. Despite the increasing trend in teleost genomics, key challenges still remain to be addressed for chromosome-scale genome assembly of teleost fishes due to high heterozygosity levels, extremely high repeat content, two rounds of whole genome duplication (2R-WGD) and teleost specific genome duplications (TGD). Here we outline key concepts and provide the roadmap for future researchers to better strategize the *de novo* genome assembly studies for teleost fishes. In this regards, following benchmarking practices were performed on moderate and highly heterozygous fish genomes: (i) a performance comparison of long-read and hybrid *de novo* genome assembler (wtDBG2, pb\_assembly, canu, flye, wengan, NextDenovo, haslr, raven, phasebook) was carried out using latest version of (ii) “scaffolding genome drafts with linked reads” which software (SLR-superscaffolder, ARBitR, ARKS,) is suitable for teleost genomes?, (iii) “from contig and scaffolds to chromosome-scale genome assembly”, taking a quick look at HiC genome assembler (3D-DNA, ALLHiC, SALSA, YaHS) and purge haplotigs (Purge Haplotigs, Purge Dups and HapSolo) for best-practices. In conclusion, regardless of heterozygosity and repeat sequence rates, we recommend following strategies: (i) avoid hybrid *de novo* genome approach, increase coverage of long-reads and long-read assembler yielded generally similar results in terms of genome size, repeat content, BUSCO results and N50, L50 metrics, (ii) linked-read sequencing data is not indispensable for *de novo* genome assembly and it relatively enhances genome quality regardless of software applied, (iii) HiC techniques significantly enhance genome assembly and YaSH-SALS-ALLHiC generates good results with small gaps and relatively short run times, (iv) haplotypic duplications and haplotigs can effectively be removed using purge\_dups software.

Acknowledgment. This study was funded by the Scientific and Technological Research Council of Turkey (TUBITAK) ARDEB 3001 Grant No: 117Z795.

**Keywords:** Teleost, Genome, *De novo* sequence assembly, benchmarking genome assembler.

**Determination of Antibody Response against  
*Aeromonas hydrophila* in Carp (*Cyprinus carpio*,  
Linnaeus 1758) Living in Sivas-Sarkisla up Kizilirmak  
Basin Çermikler Hepp Region**

Wednesday, 26<sup>th</sup> October – 14:15 - Main Conference Hall – Oral

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In this study, the motile *Aeromonas* septicemia disease caused by *Aeromonas hydrophila* was investigated by using Enzyme-linked immunosorbent assay (ELISA) in carp (*Cyprinus carpio*) which have been living in Kızılırmak- Çermikler HEPP and Sivas-Acı Su Deresi regions. Comparison was made on the antigen/antibody responses in fish serum by coated plates with *Aeromonas hydrophila* outer membrane protein (omp) and also performed with imported commercial fish IgM ELISA kit.

A statistical comparison of antibody titres of fish serum samples has been determined that there is no significant differences between the samples at the station II, which is thought to be under the threat of pollution. IgM in the serum samples was found at different concentrations in most of the fish (83%) living in areas (Station I and II) with low and high water pollution exposure. The positive results on the *A. hydrophila* coated plates was found only in fish serum (32%) living in the polluted area, and there was no statistically difference in antibody titration rates between them. As a result, IgM antibodies were detected in the serum samples of fish living in both stations, mainly due to water pollution and other disease factors.

Acknowledgment. This study was supported by Çukurova University Research Projects Unit.

Project No: FYL-2018-11153

**Keywords:** Carp (*Cyprinus carpio*), *Aeromonas hydrophila*, Motil *Aeromonas* septicemia (MAS), ELISA, Antigen, Immunoglobulins.

## Detection of the Lakes Biodiversity in the Antarctic Peninsula by eDNA Metabarcoding

Wednesday, 26<sup>th</sup> October – 14:30 - Main Conference Hall – Oral

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Antarctica has one of the most significant ecosystems in the world with its unique extreme biodiversity. Terrestrial and glacial regions, eutrophic lakes, and freshwater and saltwater ecosystems on the Antarctic Peninsula offer a wide range of habitats for living organisms. During the 2nd and 3rd Turkish Antarctic Expeditions (2018-2019), environmental DNA (eDNA) sampling was done from 4 different islands and 10 different lakes on the Antarctic peninsula. In this study, eDNA metabarcoding was used to identify biodiversity at the species level of sampled habitats within the capacity of the reference database. According to the results, PCR amplifications were performed by selecting universal primers (zooplankton (18SV9), invertebrate (COI) and phytoplankton (18SV4)). The libraries of the samples were prepared with one-step PCR and adapters were added with the adapter ligation method. Analysis was performed with a high-throughput sequencing platform to obtain paired-end amplicons with a length of 300 base pairs. Approximately 1.5 million nucleotide sequence reads were obtained. Reads were analyzed with various bioinformatics filtering steps. According to obtained lake eDNA results, living organisms such as bacteria, algae, phytoplankton, flying insects, and tardigrade specific to the Antarctic Peninsula were successfully detected at the species level. Only in the 5th lake sample (Ardley) results, *Parochlus steinenii*, the only flying insect naturally found in Antarctica, matched with this field sample. In the eDNA dataset results, a large number of matches were obtained with different dinoflagellate species. Since these species have never been seen before on the Antarctic continent, it is thought that they may be the most recent new species or species that live in lake environments.

Acknowledgment. This study was supported by AgriGenomics Hub: Animal and Plant Genomics Research Innovation Center.

**Keywords:** eDNA metabarcoding, polar ecosystems, database, Antarctica biodiversity.

## First Isolation of *Saprolegnia parasitica* in Black Sea Trout in Türkiye

Wednesday, 26<sup>th</sup> October – 14:45 - Main Conference Hall – Oral

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Black Sea trout (*Salmo labrax*) culture is a relatively new industry for Turkey, which started as an alternative to rainbow trout (*Oncorhynchus mykiss*) culture after the 2000s. Compared to rainbow trout, Black Sea trout is more susceptible to diseases, and in recent years bacterial, viral, fungal, and parasitic agents have often been reported in this species. Many species of *Saprolegnia* infecting fish, fish eggs, and amphibians have an important economic impact, especially in the freshwater ecosystem. Fungi which are capable of reproduction year-round are known as dermatomycosis due to the skin being mainly affected. The Oomycetes are known as a saprophytic opportunist pathogen, affecting fish that are physically injured or stressed. The therapeutic control of fungus is difficult because the most effective drugs such as malachite green have been restricted due to their carcinogenic effect on the environment. In this study, fungal-like lesions and mortality encountered in cultured Black Sea trout were investigated. *Saprolegnia parasitica* was isolated from diseased trout as a causative agent. For this reason, ten Black Sea trout were sampled from two trout farms just before the spawning period. The cotton wool-like fungal mats and ulceration were observed on the fish skin. The swab samples were taken from fishes, and samples were cultured in Potato Dextrose Agar supplemented with %1 penicillin-streptomycin. After the incubation at 20-22°C for 4 days, isolates were observed macroscopically and microscopically and a cotton-like appearance was characterized. The DNA of the fungus was extracted with a DNA extraction kit. The internal transcribed spacer (ITS) gene of the fungus was amplified to confirm its identity using PCR. PCR product was confirmed by DNA sequencing and read. The derived nucleotide sequences were aligned and analyzed. In this study, 9 out of 10 isolates showed the characteristic of the *Saprolegnia* spp. growth on agar. The colonies were from white to grey with a cottony surface. The results of the PCR amplification of the ITS gene showed that all suspected samples were positive for *Saprolegnia* spp. with a PCR product size of approximately 750 bp. Genetic analysis by DNA sequencing of its ITS gene confirmed that the fungus is genetically related to the *S. parasitica* strains in Genbank. The ITS gene sequence of the *S. parasitica* strain displayed 96,07% similarity with previously published *S. parasitica* strains in GenBank. As a result, to our knowledge, we reported the first identification of *S. parasitica* from cultured Black sea trout in Türkiye aquaculture environments using molecular methods.

**Keywords:** Fungus, *Saprolegnia*, Trout, ITS.

## Metabarcoding Profiles of Microbial Community in the Black Sea

Wednesday, 26<sup>th</sup> October – 15:00 - Main Conference Hall – Oral

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Diverse microbial communities in the Black Sea respond differently to environmental changes. The Black Sea has a distinct ecosystem with a thin layer of oxic-zone above and anoxic-zone below. The Black Sea microbiota has been investigated using high-throughput genomic studies, but there are no studies on seasonal and vertical fluctuations in microbial community composition, driving force, or community assembly mechanisms. Next Generation Sequencing targeting the hypervariable V3 and V4 regions of the 16S rRNA gene was used to examine the diversity, abundance, and community structure of seasonal, vertical, and horizontal microbial communities. 750 bacterial and three archaeal species from 25 different phyla were assigned to the detected OTUs. From the surface to deeper zones, the number of OTUs and the diversity of organisms increased. Similar microbial community compositions were observed at each sampling station. However, the composition of microbial communities differed dramatically vertically between zones. The community composition of seawater and sediment also differed significantly. Summer composition differed significantly from other seasons at 5 meters, while the remaining depths appeared similar. For the first time in the Black Sea, nitrite-oxidizing (*Nitrosospora tenuis*, *N. multiformis*, *Nitrosospora* rev-210106-rev *lenta*), sulfate-reducing (*Thermodesulfobacterium hydrogeniphilum*), thiosulfate-reducing (*Shewanella hafnensis*, *S. vesiculosa*), iron-reducing (*Geothrix fermentans*), Fe-Mn reducing (*Geothrix subterranea*) and electricity-producing (*Geobacter sulfurreducens*) bacteria were reported. Proteobacteria dominated all the sampling depths. The abundance of Cyanobacteria was highest in the surface mixed zone. Proteobacteria, Cyanobacteria, Bacteroidetes, and Verrucomicrobia were found across the whole water column, but Nitrospinae, Chloroflexi, and Kiritimatiellaota were limited to depths of 75 meters or deeper, where they were prevalent. Variation in the vertical composition of microbial communities is caused by environmental conditions and their responses to different ecological niches. Acknowledgment. This work study was supported by the Scientific and Technological Research Council of Turkey (grant number 117Y381).

**Keywords:** Metabarcoding, bacteria, archaea, strata, sediment.



## Antibiotic Resistance Gene Detection in Plasmids of *Lactococcus garvieae* Isolated from Rainbow Trout in Mediterranean Countries

Wednesday, 26<sup>th</sup> October – 15:30 - Main Conference Hall – Oral

**Dilek USTAOĞLU<sup>1</sup>, Mustafa TURE<sup>2</sup>, Rafet C. OZTURK<sup>1</sup>, Silvia COLUSSI<sup>3</sup>, Ana Isabel VELA<sup>4</sup>, Jose Francisco FERNANDEZ-GARAYZABAL<sup>4</sup>, Paolo PASTORINO<sup>3</sup>, L. FARIANO<sup>5</sup>, Donatella VOLPATTI<sup>6</sup>, Konstantina BITCHAVA<sup>7</sup>, Charalampos KOTZAMANIDIS<sup>7</sup>, Acutis Pier LUIGI<sup>3</sup>, Marino PREARO<sup>3</sup>, İlhan ALTINOK<sup>1</sup>**

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One of the most effective strategies for bacterial disease management and prevention in aquaculture is the appropriate use of antimicrobials. Antibiotic misuse, on the other hand, may result in antimicrobial resistance (AMR) and the spread of antibacterial resistance genes (ARGs). ARGs are extrachromosomal DNA molecules that can be transferred by mobile genetic elements such as conjugative plasmids. Plasmids were extracted using a commercial kit from *Lactococcus garvieae* and *L. petauri* strains isolated from rainbow trout farms in Turkey, Greece, Italy, and Spain (20 strains from each country). Plasmids were screened for the presence of ARGs associated with tetracycline (tetA, tetB, tetC, tetG), phenicol (floR), beta-lactamase (blaTEM, blaSHV, blaOXA), quinolones oxalonic acid (gmrA, gyrA), macrolides (ermA, ermB, ermC), and streptomycin (strB). ARGs in plasmids were found in Italian strains but not in Spanish ones. Overall, tetG (30%) was the most common gene among all examined resistance genes, followed by gyrA (7.5%), strB (6.25%), blaSHV (5%), and tetB (3.75). The tetG resistance gene was found in all strains except the Spanish ones. This study suggests that tetracycline resistance is likely widespread in the Mediterranean region. In addition, irrational antibiotic usage may result in prolonged treatments and an increase in *L. garvieae* or *L. petauri*-related mortality. ARGs carried on plasmids may have a significant role in the transmission of antimicrobial resistance and the evolution of antibacterial resistance genes in rainbow trout farms in the Mediterranean region.

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**Keywords:** Rainbow trout, *L. garvieae*, *L. petauri*, Plasmid, Antimicrobial resistance genes.

## Identification of Some Algae Species Isolated from the Central and Eastern Black Sea Coast by Molecular Methods

Wednesday, 26<sup>th</sup> October – 15:45 - Main Conference Hall – Oral

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The green algae (Chlorophyta) comprise one of the largest in terms of number of species, most widely distributed, and morphologically diverse groups of algae. Green algae include unicellular, colonial, filamentous and pseudoparenchymatous uni- or multinucleate forms and large numbers of both seaweeds and microscopic species have been described.

In this study, We aimed to characterize 8 algae isolates isolated from the Middle and East coasts of the Black Sea /Turkey by phylogenetic analyzes based on nucleotide sequences of the 18S rDNA gene region. Microscopic observations revealed that all isolates are belonging to the Chlorophyceae divisio. Species identifications of the isolates were performed using molecular phylogenetic methods depending on the nucleotide sequences of 18S rDNA, which is one of the most common markers used in phylogenetic studies.

Phylogenetic analyses revealed that isolate AT-2 is related to *Chlorella vulgaris*, where isolates AT-5, AT-6 and AT-7 to *Coccomyxa parasitica*, AT-8 to *Deuterostichococcus marinus* and AT-9, AT-11 to *Nannochloropsis oceanica* species. On the other hand AT-10 appeared as related to *Tetraselmis convolutae*-*T. striata* lineage. All these species, except *C. vulgaris* are the first records to be molecularly identified in Turkey. Additionally, our *C. vulgaris* isolate is the first record of this species to be molecularly identified from Marine environment in Turkey.

Acknowledgment. Thanks to Ilyas Kutlu for processing sequences of isolates.

**Keywords:** Black Sea, Chlorophyta, 18S rDNA, Phylogeny.

## Genetic Diversity of Whiting (*Merlangius merlangus*) in the Black Sea

Wednesday, 26<sup>th</sup> October – 16:00 - Main Conference Hall – Oral - Online

**Ayşe CEBECİ<sup>1,\*</sup>, Melike ALEMDAĞ<sup>1</sup>, Şirin FİRİDİN<sup>1</sup>**

<sup>1</sup>Central Fisheries Research Institute (SUMAE), Vali Adil Yazar Ave. No:14 Kasustu, Yomra, 61250, Trabzon, Türkiye.

Information on genetic structure and diversity is essential for sustainable fishery management and conservation of species and populations. Genetic diversity between and within populations indicates short-term individual fitness and long-term evolutionary adaptation of species. Whiting (*Merlangius merlangus*) is one of the commercially important fish species in the Black Sea, but there is limited information on genetic structure and diversity. Therefore, the genetic diversity of *Merlangius merlangus* in the Black Sea was analyzed using the cytochrome c oxidase subunit I (COI) and also the 16S ribosomal RNA (rRNA) mitochondrial gene regions in total 78 individuals from Trabzon, Sinop, Ereğli, Şile in this study. Overall, 5 haplotypes were determined for the COI gene region while 7 haplotypes were detected for the 16S rRNA gene region. Hap1 was the most common haplotype seen in all locations and the haplotype diversity was  $H_d = 0.2820$  for the COI gene region. Also, Hap:1 and 3 were common haplotypes for the 16S rRNA gene region and the haplotype diversity was  $H_d = 0.2980$ . Nucleotide diversity of 16S rRNA and COI gene regions were determined as  $\pi = 0.00079$  and  $\pi = 0.00109$ , respectively. Furthermore, phylogenetic trees constructed by maximum likelihood, and also neighbor-joining method for both gene regions using haplotypes and corresponding gene region sequences retrieved from Genbank showed that all haplotypes are bound to one major clade. The present study suggests that low levels of genetic differentiation in whiting could be related to high levels of gene flow in geographic distances due to the lack of physical barriers in the marine environment and the high dispersal rate of eggs with currents.

**Keywords:** Genetic variation, mtDNA, *Merlangius merlangus*, Black Sea.

## Isolation of Disease Agents from Cultured European Flounder (*Platichthys flesus*)

Wednesday, 26<sup>th</sup> October – 16:15 - Main Conference Hall – Oral - Online

İlhan AYDIN<sup>1,\*</sup>, Ayşe CEBECİ<sup>2</sup>, Hakan IŞIDAN<sup>3</sup>, Mustafa Türe<sup>2</sup>, Oğuzhan EROĞLU<sup>4</sup>, Şirin FİRİDİN<sup>2</sup>, Yılmaz ÇİFTÇİ<sup>5</sup>

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Sustainable aquaculture has an important role in resource conservation by meeting demand and new species are an option to contribute to sustainable aquaculture. The aquaculture potential of the European flounder was evaluated as a new species. However, a disease outbreak occurred culturing European flounder and then causative agents of disease were determined to provide proper treatment. 15 European flounders were sampled for bacterial examination following the disease outbreak. For bacterial examination, liver and head-kidney samples of fish were aseptically streaked on Thiosulfate Citrate Bile Sucrose Agar (TCBS, Merck) incubating at 25°C for 24 hours. After the incubation period, typical colonies were selected from the plate and streaked onto the same media to gain pure bacterial colonies. Biochemically characterization of the purified bacteria was conducted by following biochemical tests: Gram staining, cytochrome oxidase, catalase, and motility. Biochemical bacteria species identification was carried out by Analytical Profile Index (API 20E). The causative agent of the disease outbreak was further genetically confirmed by universal primers. According to the antibiogram tests performed against the agent, where the mortality was approximately 50%, fruzolidon, florfenicol, and oxytetracycline were found to be effective antibiotics against bacteria. In addition, parasite analysis was performed by carefully examining the skin scraping under the microscope. In conclusion, cultured European flounder were investigated for bacterial and parasitic fish pathogens, and then *Vibrio splendidus* and *Gyrodactylus* sp. were isolated as bacterial and parasitic disease agents. Based on the antibiogram results, all fish were treated with a mixture of Enrofloxacin (Baytril), Furozolidon, and Vitamin C by injection and oral route (Baytril 20 mg/kg fish + Inc.C, Intramuscular, furozolidon 100 mg/kg). 150 ppm formaldehyde was effective for 1 hour in the treatment of parasites.

**Keywords:** European flounder, disease agents, aquaculture, antibiogram.

## Investigation on the Total Phenolic Contents and Antioxidant Capacity of Seaweed *Kappaphycus alvarezii* Extract

Wednesday, 26<sup>th</sup> October – 16:30 - Main Conference Hall – Oral

Merilyn AMLANI<sup>1,3\*</sup>, Nursalyn AMLANI<sup>2</sup>, Senem YETGİN<sup>4</sup>

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Seaweeds in general are high in bioactive components such as phenolics, flavonoids, and other biological properties that are important in many biological processes in humans, animals, and plant itself. Because seaweeds are very important in variety of industries due to their numerous beneficial uses especially *K. alvarezii*, it is important to ensure that the seaweeds are of high quality. In this regard, the purpose of this study was to investigate the Total Phenolic Contents and Antioxidant Capacity of the seaweed *K. alvarezii* extract. The seaweed *K. alvarezii* was collected from the wet market of Tawi-Tawi, Philippines and was extracted using maceration method for 24 hours and had a % yield of  $2.82\% \pm 0.06$ . Then the extract was further analyze using Folin-Ciocalteu method and DPPH (2,2-diphenyl-1-picrylhydrazyl) method to determine the total phenolic contents and antioxidant capacity. Using the methods, the extracts were found to have  $22.55 \pm 0.55$  mg GAE/ 100g dry weight of total phenolic contents and an IC<sub>50</sub> of  $1.01 \pm 0.05$  mg/ml for the antioxidant capacity. According to the findings, seaweed *K. alvarezii*, is a good quality seaweed with a reasonable amount of total phenolic contents and antioxidant capacity, which are important in the consumer's biological processes.

**Keywords:** *Kappaphycus alvarezii*, Seaweeds, Bioactive Compounds, Total Phenolic Contents, Antioxidant Capacity.

## Comparison of Israeli Carp Meat, Scales, Internal Organs and Bone Structures in Terms Of Lipid Oxidation Parameters

Wednesday, 26<sup>th</sup> October – 16:45 - Main Conference Hall – Oral

Koray KORKMAZ<sup>1,\*</sup>

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Lipid is one of the basic components of fish, and its amount is highly variable compared to the amount of protein, water, and mineral matter. Changes in the amount of fish lipids lead to changes in the amount and composition of polyunsaturated fatty acids in the lipids. In this study, the use of meat, scales, viscera, and bony structures in Israeli carp (*Carassius gibelio*), an invasive and non-economic species obtained from the Karadeniz, was investigated both as an alternative lipid source for human consumption and as a functional product to increase nutritional value as animal feed. Its use as an alternative product has been investigated. In this context, lipid oxidation analyses were examined in terms of peroxide value (PV), free fatty acids (FFA), and thiobarbituric acid (TBA) values. In general, the highest oxidation values were observed in the internal organs, while the lowest values were observed in flakes in terms of PV and in meat in terms of FFA. The highest PV was observed in internal organs (3.8 meq O<sub>2</sub>/kg) and the lowest in scales (2.47 meq O<sub>2</sub>/kg). In terms of FFA, values were observed in the range of 3.34 - 8.33% and the highest and lowest values were observed in the internal organs and meat, respectively. Although the meat, scale, and bony structures were similar and had the lowest values in terms of TBA, the internal organs were observed at the highest values with 0.08 mg MA/kg. Recycling and use of food wastes have started to be promoted especially in developed countries. By-products formed during the processing of foods are released in varying amounts after the processes applied by the food industry. Many food wastes are a valuable source of nutrients with their protein, carbohydrate, and lipid contents. The evaluation of the by-products obtained in the food industry and the development of new functional products attract great attention in terms of providing a significant economic return at the industrial level. In light of this information, since these rates obtained from the study are generally within acceptable limits, it can be considered to use Israeli carp meat as well as its by-products as an alternative lipid source.

Acknowledgement. This study was supported by Scientific Research and Projects Unit of Ordu University (Project ID A:2103).

**Keywords:** Israeli carp, waste assessment, alternative source, nutritional content.

## Comparison of Protein Hydrolysate Oil Obtained by Two Different Enzymes Using Rainbow Trout (*Oncorhynchus mykiss*) By-Products in Terms Of Lipid Oxidation Parameters

Wednesday, 26<sup>th</sup> October – 17:00 - Main Conference Hall – Oral

**Koray KORKMAZ<sup>1,\*</sup>, Yılmaz UÇAR<sup>1</sup>, Serpil ÖZTÜRK<sup>1</sup>, Bahar TOKUR<sup>1</sup>**

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Since fish oil is the main source of  $\omega$ -3 PUFAs, the resulting lipids can be used for human and animal consumption. In hydrolysate production, a significant amount of fish oil is obtained in the upper phase from the separation phases that occur after the proteins are separated. For this reason, it is extremely important to bring the unutilized parts of the salmon, which are produced in our country and have economic potential, to the economy. The possibilities of using fish oil as a functional food raw material after the production of protein hydrolysate from rainbow trout processing by-products were evaluated by performing quality parameter analyses. Thus, it is aimed to bring products with high added value to the national and regional economy by investigating their suitability for human or animal consumption. New approaches have been developed to convert economically low-value fish processing wastes into high-value products such as polyunsaturated fatty acids (PUFA), physiologically important peptides, saccharides, and other bioactive compounds. These recoverable compounds allow to improve human health and increase the use of waste. The suitability of the lipid quality of the oil produced during this process for human and animal consumption in terms of thiobarbituric acid (TBA), peroxide value (PV), and free fatty acids (FFA) was investigated. In general, the highest oxidation values were observed in the flavorenszyme, while the lowest values were observed in the control group in terms of PV and FFA. The highest PV flavorenszyme (3.2 meq O<sub>2</sub>/kg) and the lowest were observed in the control group (1.68 meq O<sub>2</sub>/kg). In terms of FFA, values were observed in the range of 2.69 - 8.16% and the highest and lowest values were observed in the control group and flavorenszyme, respectively. In terms of TBA, although the control group was similar to flavorenszym and alcalase and had the lowest values, the control group had the highest values with 0.16 mg MA/kg. The evaluation of the by-products obtained in the seafood processing industry and the development of new functional products are gaining importance in terms of providing economic returns. In the light of this information, since the results obtained from the study are generally within acceptable limits, it can be considered to use protein hydrolysate oil obtained with two different enzymes by using rainbow trout (*Oncorhynchus mykiss*) by-products as an alternative lipid source.

Acknowledgement. This study was supported by Scientific Research and Projects Unit of Ordu University (Project ID B:2207).

**Keywords:** Protein hydrolysate oil, enzymes, rainbow trout, lipid oxidation, by-product.

## Acceptability of Different Concentrations of *Chlorella* sp. in Filipino Delicacy Puto as Coloring Agent

Wednesday, 26<sup>th</sup> October – 17:15 - Main Conference Hall – Oral

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Puto products with colored flavors are gaining popularity. Using natural colorants in food development and improving health is crucial. Colorants from *Chlorella* sp. contribute to food nutrition and improve human health. In this study, we evaluated Puto's sensory properties by adding different levels of microalga *Chlorella* sp. (0, 0.5, 1, and 2%). Furthermore, total carotenoid quantities and chlorophyll *a* of *Chlorella* powder were also measured. Puto samples did not appear to be affected by the natural colorant *Chlorella* sp. at all concentrations ( $p > 0.05$ ). However, the smell, texture, taste, and overall acceptability of 2% *Chlorella* sp., Puto varied significantly ( $p < 0.05$ ). *Chlorella* sp. powder constituted  $4004.79 \pm 119.1 \mu\text{g}\cdot\text{g}^{-1}$  chlorophyll *a* and  $1442.67 \pm 74.41 \mu\text{g}\cdot\text{g}^{-1}$  total carotenoids. There were  $1442.67 \pm 74.41 \mu\text{g}\cdot\text{g}^{-1}$  total carotenoids and  $4004.79 \pm 119.1 \mu\text{g}\cdot\text{g}^{-1}$  chlorophyll *a* in *Chlorella* sp. powder. In the experimental groups, total carotenoids ranged from  $5.59 \pm 0.37 \mu\text{g}\cdot\text{g}^{-1}$  and  $18.06 \pm 0.66 \mu\text{g}\cdot\text{g}^{-1}$  while chlorophyll amounts ranged from  $14.34 \pm 0.49 \mu\text{g}\cdot\text{g}^{-1}$  to  $54.06 \pm 1.71 \mu\text{g}\cdot\text{g}^{-1}$ . Puto used these biomasses as natural colorants at a level of 0.5%, 1%, and 2%. However, at 2% *Chlorella* sp., carotenoids, and chlorophyll pigment levels are too high for Puto production. Hence, The Filipino delicacy Puto would benefit from adding *Chlorella* sp. biomass at 0.5% and 1%.

**Keywords:** *Chlorella* sp., pigment, colorant, Puto, microalgae.



## The Role of Fish Protein Hydrolysate Addition on Fish Mince Quality Subjected to Freeze-Thaw cycles

Wednesday, 26<sup>th</sup> October – 17:30 - Main Conference Hall – Oral

**Gülsüm BALÇIK MISİR<sup>1</sup>\*, Büket Buşra DAĞTEKİN<sup>1</sup>, Sebahattin KUTLU<sup>1</sup>**

<sup>1</sup>Central Fisheries Research Institute (SUMAE), Vali Adil Yazar Ave. No:14 Kasustu, Yomra, 61250, Trabzon, Türkiye.

One of the measures taken against the global food crisis and climate change is the waste policy. The most appropriate use of existing natural resources is inevitable for future generations as it is today. In this study, fish protein hydrolysate produced from sprat (*Sprattus sprattus* L., 1758), which is not used as human food in Turkey but evaluated in the feed sector such as fish meal-oil with low economic value, was used as an alternative natural product to synthetic additives against quality deterioration in the freezing-thawing cycles of trout (*Oncorhynchus mykiss*) minced meat. Trout was filleted and minced with a meat grinder. Minced meat was divided into 4 groups; CFM: (without adding FPH), SSFM: (4% sucrose 4% sorbitol added group), THFM: (Traditional enzymatic fish protein hydrolysate added group including 74.45% protein and 2.05% crude lipid) and UHFM: (ultrasound assisted enzymatic fish protein hydrolysate added group including 75.88% protein and 1.51% crude lipid). All groups were packaged in polyethylene bags and stored at -18 °C. Six freeze-thaw (F-T) cycles were applied to all groups and analyzed 15-day intervals. The highest TVB-N value was 36.42 mg/100 g in CFM in 6th F-T; the lowest was 12.61 mg/100 g detected in SSFM at day 0. The highest coking loss was determined as 29.86% for SSFM in 6. F- T; the lowest was found for GHFM as 8.06% at 0 Day. Therefore, sprat hydrolysates could be a potential natural additive in the preservation of fish mince.

Acknowledgment. This study was prepared from the Project “The Effect of Ultrasound Assisted Protein Hydrolysate Production and the Possibility of Use in Some Processed Foods” with the number TAGEM/HSGYAD/B/19/A3/P3/1024.

**Keywords:** Fish protein hydrolysate, fish mince, freeze-thaw, and sprat.

## Edible Marine Gastropod and Bivalve Species Sold in the Local Market during Ramadan in Tawi-Tawi, Philippines

Wednesday, 26<sup>th</sup> October – 17:45 - Main Conference Hall – Oral

**Gerly-Ayn TUPAS<sup>1,4,\*</sup>, Gerwin TUPAS<sup>2,3</sup>, Norwely TUPAS<sup>3</sup>, Soner BİLEN<sup>5</sup>**

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Tawi-Tawi, which is situated in the southernmost part of the Philippines established a so called *tabub-tabub* (market during afternoon of Ramadan) and most for sale items were marine products such as different species of pelagic and demersal fishes, seaweeds, sea cucumber, sea anemone, sea urchin, bivalves and gastropod species; however, local desserts and other agricultural products were also present. In this current study, the composition of edible marine gastropod and bivalve species in Tawi-Tawi were surveyed during Ramadan in 2022. The samples were surveyed from two major landing centers in Tawi-Tawi, namely; Bongao Public wet market and Batu-Batu Panglima sugala public market. A total of 16 gastropod and bivalve species were documented sold in both markets during the Ramadan period. Two species (*Hippopus hippopus* and *Tridacna maxima*) were found on the list of Convention on International Trade in Endangered Species (CITES) and one locally threatened gastropod (*Tectus niloticus*) was noted during the survey. Prices ranged from 10 Php to 150 Php (0.36 USD to 2.71 USD) depending on the heap of the products. Observations were limited to prices and all sold marine gastropods and bivalves during Ramadan and suggested an extensive survey on Tawi-Tawi Bay. This study contributes to data gaps in conchological literature in the Philippines.

**Keywords:** Gastropod, Bivalve, Market, Marine products, Resource management, Conchology.

## Comparison of Functional Properties of Protein Powders Produced from Sprat (*Sprattus sprattus* L., 1758) by Two Different Methods

Wednesday, 26<sup>th</sup> October – 18:00 - Main Conference Hall – Oral

**Büket Buşra DAĞTEKİN<sup>1,\*</sup>, Gülsüm BALÇIK MISIR<sup>1</sup>, Sebahattin KUTLU<sup>1</sup>,  
Ahmet Faruk YEŞİLSU<sup>1</sup>**

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In this study, it is aimed to transform the sprat into a form as fish protein powder that can be evaluated for human consumption, which is caught average of 50,000 tons annually and used as raw material in fish meal-oil factories and not demanded by the consumer in Türkiye. For this purpose, acid and alkali (AC and AL) protein isolate with pH shift method, and protein hydrolysate (H) with enzymatic method, were produced from sprat and compared to functional properties of these protein powders. While the crude protein value of the sprat was 14.43%, this value was the highest in AL (76.06%), and followed by AC (75.97%) and H (74.85%). It was observed that the AL has the highest emulsion capacity (65.66%), it was followed by H (65.01%) and AC (64.66%). H was the best among groups; for emulsion stability (84.62%), oil binding capacity (3.86 g oil/g), foaming capacity and stability (18 and 39.19% respectively) and antioxidant activity means. AC has the maximum water holding capacity (9.75%) it was followed by AL (8.69 ml/g) and H (5.68 ml/g). The results of study showed that, sprat has been converted into fish protein powder forms which could be used in the development of different products as protein isolate and hydrolysate. The protein powders can be used as coating material, cryoprotectant, or as additive in food.

Acknowledgment. This study was funded by the General Directorate of Agricultural Research and Policies (Republic of Türkiye Ministry of Agriculture, and Forestry, Türkiye) (Project No: TAGEM/HSGYAD/B/18/A3/P4/402).

**Keywords:** Sprat, protein isolate, protein hydrolysate.

## Changes of Fatty Acids and Lipid Quality Indexes of Fish Fingers Produced by pH Shifting Method from Prussian Carp (*Carassius gibelio* Bloch, 1782) During Frozen Storage (-18°C)

Wednesday, 26<sup>th</sup> October – 18:15 - Main Conference Hall – Oral

Büket Buşra DAĞTEKİN<sup>1,\*</sup>

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In this study, changes of fatty acids and lipid quality indexes of fish fingers which was produced from mince and protein isolate (acid and alkaline) of Prussian carp (*Carassius gibelio* Bloch, 1782) were investigated. Average content of saturated fatty acids in fish mince, acid and alkaline protein isolate fish finger groups was calculated as 12.00, 10.83 and 11.15 %, respectively. Monounsaturated fatty acids and polyunsaturated fatty acids were determined 29.84, 31.03, 31.17% and 53.10, 53.02, 52.67%, in the same order. As a result of the study, the averages value of S/P, AI, TI, and h/H of the lipid quality indices were calculated as 0.13, 0.11, 0.23, and 10.42 in fish fingers obtained from minced meat. In the same order, these values was computed as 0.12, 0.09, 0.22, and 11.94 in acid isolate fish fingers while 0.12, 0.10, 0.23 and 11.40 in alkaline protein isolate. AI and TI values higher than (>1.0) are harmful for human health. In addition to this, the high ratio of h/H fatty acids is an indication that the oil contained in the product is suitable for nutrition. As a result of the study showing that, fish fingers which produced from Prussian carp is quite good for human nutrition.

Acknowledgment. This paper is dedicated to the memory of Özden BAŞTÜRK who supervised PhD thesis that is the basis of this work. This study was performed as a PhD thesis project [BAP-FBE SÜ (BBG) 2011-4 DR] granted by the Mersin University Scientific Research Project Unit (Mersin University, Türkiye).

**Keywords:** *Carassius gibelio*, Acid Protein Isolate, Alkaline Protein Isolate, Fish Finger.

## Active Films Based on Polycaprolactone/Fish Gelatin Electrospun Nanofibers Including Egg White Protein

Wednesday, 26<sup>th</sup> October – 18:30 - Main Conference Hall – Oral

**Esen ALP -ERBAY<sup>1,\*</sup>, Ahmet Faruk YEŞİLSU<sup>1</sup>, Mustafa TÜRE<sup>1</sup>**

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Avidin which is one of the precious proteins of egg white was utilized to inhibit fish originated microorganisms, *i.e.*, *E. coli*, *Shewanella putrefaciens*, *Flavobacterium psychrophilum* and *Pseudomonas spp.* Avidin is a positively charged and glycosylated egg white protein. It has capability to bind biotin and form stable complexes. Egg white is very rich in antibacterial proteins including lysozyme and ovotransferrin. Avidin is also suggested as an antimicrobial agent. However, the antimicrobial activity of avidin has not been clearly understood. The antimicrobial property of this protein is attributed to its biotin binding capability which limits most of the bacteria's proliferation. In this regard, avidin was loaded in polycaprolactone (PCL)/ fish gelatin (FG) nanofibers by electrospinning to obtain active films for food packaging. The inhibition activity of the avidin was dose dependent. Mostly inhibited bacteria was *Shewanella putrefaciens* by 15% avidin including PCL/FG electrospun nanofibers. Followed by *Pseudomonas spp.*, *Flavobacterium psychrophilum* and *E. coli* respectively. Fish gelatin has a hydrophilic character according to the contact angle measurements. This was enhanced by adding different ratios of PCL which displays a hydrophobic character. Avidin including fish gelatin nanofibers exhibited poor mechanical characterization which is attributed to weakened fish gelatin molecular bonding in presence of higher amounts of avidin. However PCL/ FG electrospun nanofibers showed strong mechanical properties in contrast to neat fish gelatin. As a result, avidin incorporated PCL/FG electrospun nanofibers are promising in inhibiting fish originated microorganisms.

**Keywords:** Antimicrobial, egg white protein, avidin, electrospinning, nanofiber, fish pathogens.

International Symposium on Fisheries and Aquatic Sciences

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Poster Presentations

## Effects of phytic acid and phytase on digestive enzymes of redclaw crayfish *Cherax quadricarinatus*

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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The redclaw crayfish (*Cherax quadricarinatus*) is a freshwater species from N Australia and SE Papua New Guinea. Redclaw has a good growth rate, easy general management, tolerance to variations in water quality, and adaptability to intensification. These characteristics have increased its cultivation by 40,000 t/year since the late 1990s. The feed can constitute up to 70% of the operating cost in aquaculture, making it a critical factor for aquaculture. Studies highlighted the performance of cheaper proteins from plant origin in redclaw diets. However, special attention should be paid to the presence of phytic acid (PA) and its antinutritional properties. To evaluate the effect of PA in the diet of *C. quadricarinatus*, a multifactorial *in vitro* assay was performed. Three levels of PA content (0.56, 1.68, and 2.80%) and three levels of phytase (PHY) as an exogenous additive (0, 250, and 500 U/kg DM) were tested under a completely randomized design. Adults of the species consuming a known balanced diet were anesthetized and sacrificed. Their hepatopancreas were carefully dissected, homogenized 1:10 w/v in distilled water at 4°C, and centrifuged to obtain enzyme extract. Alkaline protease,  $\alpha$ -amylase, cellulase (CMCase), and phytase (not detected) activities of the species were colorimetrically determined at pH 7.5 and 27°C. The digestion mixture consisted of 5mg of crude protein ( $\approx$ 11mg of diet) with hepatopancreas extract according to the *in vivo* alkaline protease-substrate ratio. These triplicated incubations were carried out for 4 h in tubes under the same pH and temperature conditions. After that, the remaining enzyme activities were evaluated. The resulting data were analyzed with ANOVA and Tukey ( $\alpha = 0.05$ ). The remaining alkaline protease activity responded negatively to

increasing dietary PA content, and positively to increasing phytase doses ( $p < 0.0001$ ), but there was no response to their interaction ( $p = 0.2049$ ). It might be explained by digestive pH. The pH above the isoelectric points of dietary proteins leads to the formation of ternary complexes. Negatively charged ends of proteins and PA are bound by cation bridging (usually  $\text{Ca}^{2+}$ ). Cellulase did not respond significantly to interaction. Neither to the factors *per se*. Although a slight negative trend was observed at increasing levels of PA ( $p = 0.0683$ ). This would represent an advantage for the inclusion of cellulose as an energy source in redclaw diets. Finally,  $\alpha$ -amylase evidenced response to the PAxPHY interaction ( $p = 0.0402$ ) probably due to a negative effect of PA through two pathways: directly interacting with the substrate (starch), and indirectly chelating  $\text{Ca}^{2+}$  which is a cofactor of the enzyme. Therefore, *in vivo* trials should be carried out to advance the study of protein, energy, and mineral digestibility of diets with different levels of PA and the role of PHY as an additive in redclaw.

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**Keywords:** Hepatopancreas, interaction, protease, amylase, cellulose.



## Distribution and Biological Characteristics of *Alloteuthis Media* (Linnaeus, 1758) In the Northern and Central Adriatic Sea

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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Two species of the genus *Alloteuthis* inhabit the Adriatic Sea: *Alloteuthis media* and *A. subulata*. *A. media* has small body dimensions and it is widespread in the Adriatic Sea. Although it is not considered as one of the commercially important cephalopods, this abundant species is regularly caught with bottom trawls in the Adriatic Sea, and thus appears at local fish markets together with small *L. vulgaris* and *A. subulata*. The data collected during MEDITS expeditions in the period from 1996 to 2015 were used to calculate the abundance and biomass indices, and spatial and depth distribution of the species in GSA 17. In addition, 1102 specimens of *A. media* collected during expeditions in 2000, 2004 and 2011 were analysed in the laboratory to examine the composition of the caught population, to calculate length-weight relationships and lengths at first sexual maturity. The highest mean abundance and biomass indices of the species were found in the stratum 100-200 m and 50-100 m, respectively. The lowest mean abundance and biomass indices were registered in the stratum 200-500 m. Females reach larger mantle lengths than males, and also dominate in number when compared to males. Analyses of the length-weight relationship showed a negative allometric growth for both sexes thus indicating that all individuals of *A. media* grew faster in length than in weight. The results also showed that males reach first sexual maturity at smaller mantle lengths than females.

## A Study on Virulence Differences of Isolates of Viral Hemorrhagic Septicemia Virus (VHSV) Purified Using Plaque Test

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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Viral Hemorrhagic Septicemia Virus (*Piscine novirhabdovirus*) is Novirhabdovirus within the order Rhabdoviridae family. The virion is an enveloped, non-segmented negative-sense single-stranded RNA molecules. The gene sequence which encodes six proteins of the virus is 3'-N (nucleoprotein)-P (polymerase-dependent phosphoprotein)-M (matrix)-G (glycoprotein)-NV (protein nonvirion) -L (RNA-dependent polymerase)-5'. The virus causes infection in various marine and freshwater fish. Infection can occur in fish of any age, but it causes significant mortality, especially in fry and young fish. In this study, Bolu/06 and TR-WS13G VHSV isolates were purified (three reps) by plaque purification method. At the end of the test, 4 different purified isolates, which form wide-narrow plaques of both isolates, were given intraperitoneal to rainbow trout weighing 60-100 g and experimental infection was performed. Mortality rate due to experimental infection were detected as; %3.33 for control group; %43.3 for Bolu/06 narrow isolates group, %20 for Bolu/06 wide isolates group, %33.3 for TR-SW-13 broad isolates group; and %14.8 for TR-SW-13 narrow isolates group. As a result, phenotypic character of the wide narrow- plaque forming isolates freshwater isolation Bolu / 06 and marine isolation TR-WS13G, have a higher mortality rate than wide plaque-forming isolates of narrow-plate isolates. This result showed phenotypic character has been shown to be significantly effective on virulence.

**Keywords:** Plaque Test; Viral Hemorrhagic Septicemia Virus; Rainbow Trout.

## Could cellulase enhance phytase activity in rainbow trout (*Oncorhynchus mykiss*)? A combination of Response Surface Methodology and *in vitro* assays

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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Complete dephosphorylation of the phytic acid (PA) of plant ingredients within the fish gastrointestinal tract has not yet been achieved. Phytases could be limited by the presence of anti-nutritional factors such as non-starch polysaccharides (NSP). The NSP (cellulose, hemicellulose, and pectins) content in soybean meal (SBM) is in the order of 15 to 20%. Insoluble NSP exerts an effect of encapsulation of nutrients, being eliminated by the fecal route. The strategic addition of exogenous non-starch carbohydrases could play a substantial role in increasing nutrient utilization. This work aimed to study the bioaccessibility of SBM proteins, PA, and cellulose using *Butiauxella spp.* phytase and *A. niger* endoglucanase (cellulase) under different simulated gastric conditions of rainbow trout. *In vitro* rainbow trout digestive assays were combined with a Response Surface Methodology (RSM) for the assessment. The mixture consisted of 200 mg of SBM (46.9% CP) with pH 2, 4, or 6 buffer (100mM Gly–HCl or Acetic acid–Acetate). After 30 minutes of initial solubilization, 31.1 units of rainbow trout stomach acid protease/mg of SBM protein were added, according to the gastric enzyme-to-substrate ratio of the species. Phytase and cellulase doses were liquidly added at 0, 2000, and 4000 U/kg SBM. The enzymatic hydrolysis was performed for three hours with continuous stirring (250 rpm) over a multiple magnetic stirrer plate at 6, 12, or 18°C. The released soluble phosphorus (P), amino acids (AA), reducing sugars (RS), and soluble protein were colorimetrically determined. A 3-level Box-Behnken factorial design (BBD) was obtained with Minitab® 18 software (Minitab Inc.). The BBD consisted of 4 factors (temperature, pH, phytase, and cellulase, 3 levels each one), 3 central points, and 2 replicates (54 total runs). Orthogonal least-squares calculation on factorial design data was used to obtain empirical equations describing the nutrient release as a dependent variable related to the aforementioned factors. The general form of the polynomial equations was:  $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_{12}X_1X_2 + \beta_{13}X_1X_3 + \beta_{14}X_1X_4 + \beta_{23}X_2X_3 + \beta_{24}X_2X_4 + \beta_{34}X_3X_4 + \beta_{11}X_1^2 + \beta_{22}X_2^2 + \beta_{33}X_3^2 + \beta_{44}X_4^2$ . Hierarchical models were applied according to the principle of parsimony and the

simplified models obtained expressed in uncoded units were: 1)  $P \text{ (mg/g)} = 3.91 + 0.29 \text{ temp} - 0.69 \text{ pH} + 1.27 \text{ phytase} - 1.56 \text{ pH}^2 - 0.91 \text{ phytase}^2 - 0.53 \text{ pH*phytase}$ ; 2)  $AA \text{ (mg/g)} = 46.81 + 2.71 \text{ temp} - 4.43 \text{ pH} + 1.63 \text{ phytase} + 10.88 \text{ pH}^2 + 0.82 \text{ temp*pH} + 1.36 \text{ temp*phytase} - 0.76 \text{ pH*phytase}$ ; 3)  $RS \text{ (mg/g)} = 8.72 + 0.54 \text{ temp} + 1.44 \text{ pH} + 1.51 \text{ cellulase} - 0.70 \text{ pH}^2$ ; and 4)  $\text{Soluble protein (mg/g)} = 5.18 + 2.52 \text{ temp} + 1.73 \text{ pH} + 1.39 \text{ phytase} + 0.93 \text{ cellulase} - 3.00 \text{ temp}^2 + 10.14 \text{ pH}^2 + 1.06 \text{ temp*pH} - 1.01 \text{ pH*phytase} - 1.07 \text{ phytase*cellulase}$ . All the models were significant ( $p < 0.05$ ) and fitted ( $R^2$  between 0.84 to 0.98). The presence of the  $\text{pH}^2$  term reveals an optimum for all response variables. Phytase dose is a well-known key to releasing phytic P, but it also appeared to interact with temperature and pH for AA. For the soluble protein, many terms were significant, highlighting the interaction of phytase by cellulase, but without effects on AA. In conclusion, not enough synergistic impact on nutrient release by enzymatic additives was achieved to encourage cellulase inclusion in rainbow trout feeds. However, additional assays should be conducted with other non-starch carbohydrases, such as pectinases and  $\beta$ -mannanases and their combinations with phytase, for a more comprehensive understanding of their interactions in fish digestion.

**Keywords:** Anti-nutritional factors, non-starch polysaccharides, nutrient bioaccessibility, interaction, synergistic effects

## Molecular Study of Caspian Roach Populations in the Southern Caspian Sea

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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The Caspian Roach, *Rutilus caspicus* (Yakovlev, 1870) is a semi-anadromous commercial species which occurs in the shallow brackish waters of the Caspian Sea. Previous morphological studies indicated the existence of two distinct strains on the south western and south eastern coasts of the Caspian Sea in the Anzali Lagoon (*kurensis*) and the Bay of Gorgan (*kinopowitschi*) or two subspecies of *Rutilus rutilus*. Seven fragments of mitochondrial gene (*Cyt-b*, 1140 bp) from each population amplified and sequenced for testing these assumptions. Genetic variation within populations was 0.7% and 0.2% (bp) for the Anzali Lagoon and the Gorgan Bay respectively, while the average genetic distance between these populations was as low as 0.5% (bp). In comparison with *Rutilus rutilus*, haplotypes were as distinct as different species with more than 4.4% bp average genetic distance. Shared haplotypes with *Rutilus frisii* also revealed hybridization between the two species in a few cases. Totally based on the sequence of *Cytb* there is no subspecies or stain of *Rutilus caspicus* in the southern Caspian Sea and morphological differences are more affected by environmental factors. Also, all haplotypes belong to *Rutilus caspicus* in a monophyletic group. This species is being cultured and released into the Caspian Sea for restocking. regular monitoring of genetic variability among the progenies is essential to avoid the loss of current polymorphism due to inbreeding problems.

**Keywords:** *Rutilus caspicus*, Caspian Sea, *Cyt-b*.

## Protocol Optimization for eDNA Extraction via Cutting the Casing of Capsulated Filter

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

**Pelin TAŞ<sup>1,2,\*</sup>, Esra Mine ÜNAL<sup>1,2</sup>, Atakan PİPILOS<sup>1,2</sup>, Emre KESKİN<sup>2</sup>**

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DNA extraction from environmental samples using capsule filters is an important step for determining biodiversity in the aquatic environment. New sequencing technologies may require high concentrations of extracted DNA that may be difficult to achieve for some sample types. A comparison of the filter cutting method for DNA extraction from the capsule filter using different extraction kits was performed. Water samples were taken from an aquarium tank which had fish. Water was filtered per capsule filter with a pore size of 0.45 µm. The main purpose was to cut and remove the filter in a closed system under sterile conditions, cut into small pieces, and put them into a new 2 mL tube. In the DNA extraction step, Qiagen B&T, Eurx T&B, Eurx Biotrace and Vazyme T&B Extraction kits were used. PCR amplifications were performed using primers targeting 12S gene fragments for fish. Then it was sequenced with Illumina MiSeq. As a result, it was determined that the DNA yield increased significantly with Eurx Biotrace, and more intact DNA was observed in the DNA gel image compared to the standard approach. In addition, the protocol successfully enabled the detection of all fish species found in the sampling environment.

Acknowledgment. This study was supported by AgriGenomics Hub: Animal and Plant Genomics Research Innovation Center.

**Keywords:** Environmental DNA, Metabarcoding, Capsule Filters, High Throughput Sequencing

## The Effect of DNA Extraction Methods on Metabarcoding Results

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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Environmental DNA (eDNA) is becoming an important way to study and keep track of biodiversity and the structure of communities. A key part of how the samples are represented is how well eDNA is removed from the filter surface. Optimization of the extraction method using capsule filters is essential. In this study, six different extraction methods were employed using six different universal primers for fishes, plants, and invertebrates. Water samples are taken from an aquarium tank which inhabits aquatic fishes, plants, and crustaceans and 500 ml of water has been filtered using filters with a pore size of 0.45 µm. eDNA was extracted from these filters using six different protocols that were optimized with a Qiagen B&T kit. The PCR yields were indexed using an adapter ligation protocol and sequenced through 2×300 bp Illumina MiSeq. When DNA and PCR bands were evaluated, it was determined that the yield was low in 2 out of 6 results. Approximately the same results were obtained for 4 of them in NGS data. While the best results were obtained with the short-region fish primer, the expected yield was not obtained from the invertebrate and plant primers.

Acknowledgment. This study was supported by AgriGenomics Hub: Animal and Plant Genomics Research Innovation Center.

**Keyword:** Environmental DNA, Extraction Methods, High Throughput Sequencing, PCR Yield.

## Detection of the River Biodiversity in Robert Island in the Antarctic Peninsula by eDNA Metabarcoding

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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Terrestrial and glacial regions, eutrophic lakes, freshwater, and saltwater ecosystems on the Antarctic Peninsula offer a wide range of habitats for living organisms. Detection of Antarctic biodiversity and revealing the relationships between species in this biodiversity are of great importance for future conservation studies. Molecular studies are of great importance to better understanding this change and its consequences. Environmental DNA (eDNA) was collected from a river in the Antarctic peninsula during the 2nd and 3rd Turkish Antarctic Expeditions (2018–2019). In this study, eDNA metabarcoding was used to detect upstream and downstream biodiversity at the species level. PCR amplifications were done using universal zooplankton (18SV9), invertebrate (COI) and phytoplankton (18SV4) primers. One-step PCR was performed and adapters were added with the adaptor ligation method for the library step. Illumina's next-generation sequencing platform was used to obtain paired-end amplicons with a length of 300 base pairs. About 1.5 million nucleotide sequence reads were obtained per library. Sequences were filtered with various bioinformatics filtration steps. Our upstream and downstream results showed there was no significant result between the two sampled areas. The resulting filtered sequences were matched with EMBL/NCBI databases for zooplanktonic, phytoplanktonic, and invertebrate species. When the results were examined, it was seen that the Antarctic river species could be successfully identified at the species level (such as Antarctic bacteria, algae, phytoplankton and tardigrade species).

Acknowledgment. This study was supported by AgriGenomics Hub: Animal and Plant Genomics Research Innovation Center.

**Keywords:** eDNA metabarcoding, polar ecosystems, database, Antarctica biodiversity.



## The Reality of Recreational Fisheries Economics in Algeria

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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At the FAO level, data on Algerian recreational fishing is lacking, this fishing is often considered to have no impact on the country's resource and economy, but the reality is completely different. Based on the daily catch data, at a port in western Algeria, it turned out that nine vessels operating as professionals were in reality recreational ones. The average annual catch was then calculated for this port and multiplied by number of authorizations nationally delivered to have a national recreational catch. To be conservative, only 75% of delivered authorization was considered in calculation. Recreational fishing and spear-fishing catch valuation is estimated at over 4,700 tonnes which is in direct competition with the artisanal commercial sector reaching commercial markets each year. The landing consists mainly of: 21% sparidae, 19% cephalopods, 10% sardinella (*Sardinella aurita*), 10% bug (*Boops boops*), 8.3% horse mackerel (*Trachurus spp.*), about 6% small tunas, and 1% hake (*Merluccius merluccius*). This practice exerts additional pressure on an already declining resource and generates a profit per fisherman of 2,146,100 DA / year and a loss in the government rent estimated at 821,574,000 DA between 2011 and 2015. Insufficient and failing regulations which allows the sanction only in case of sale without any other restriction as well as an insufficient control are implicated to explain this unfair competition between the commercial and recreational sector.

**Keywords:** Recreational fisheries, economic, Algeria.

## Nutrient Valuation of Azolla for Fish Feeding, Case of Algeria

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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Azolla is an aquatic plant which found in freshwater. This plant is available in different bioclimatic stages of Algeria. This study was conducted to evaluate the nutritional composition of Azolla. This is the purpose for which Azolla was cultivated by using the water of tilapia farming. We have also cultivated azolla by using a cow dung. We harvested the azolla in a region characterized by semi-arid climatic stage at a cold winter. A sample of the azolla's meal was dried into 45°C of temperature for using in biochemical analysis. The plots raised are used to cultivate azolla, a sheet of polyethylene was placed on the bed so that it can maintain a volume of water still. A finely sieved soil sample is spread over the bed to provide nutrients to the Azolla plants (The depth of the soil layer is about 10 cm). a pre-rotten (conserved for 5 day) cow dung is mixed with water like carbon source. The nutritive value of Azolla is satisfactory, it is rich in proteins, it contains 22.13% of proteins crude, 0.56 % of the fats crude, 2.31 of the total sugars, 14.70 % of cellulose, 17.01 % of carbohydrates, and 160.60 Kcal/100g of energy. These results are encouraging for azolla's utilization on fish farming as a natural food of tilapia, but Azolla cultivation by cow dung has been damaged after a few days. We had also compared the growth of tilapia fingerlings between using azolla as a natural food and an artificial diet showed that the digestibility of azolla by tilapia fry was low and cases of mortality have been recorded.

Acknowledgment. The authors thanks Mr Tarek Ben Ali for his help in harvesting the azolla.

**Keywords:** Azolla, Feed, Nutrition, Protein, Tilapia.

## Diet of the Warty Crab *Eriphia verrucos* (Forskål, 1775) in the Eastern Adriatic Sea

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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This paper presents the research on the bioecological characteristics of the warty crab *Eriphia verrucos* (Forskål, 1775) along the eastern Adriatic. In total, 73 individuals of which 35 males and 38 females, were collected from the coastal area of the eastern Adriatic Sea in the intertidal zone. The mean value of *E. verrucosa* of carapace length (CL) in the studied sample was 45.56 mm in the range of 19.26 to 62.6 mm, and the mean value of body weight (W) was 119.81 g in the range of 7.26 to 263.85 g. After section the stomach the fullness of them was analyzed through four categories of fullness (A = 25% or less, B = 50%, C = 75% and D = 100%). Analysis of gastric content showed that warty crab prefers groups of prey such as shellfish (73.81%), algae (66.67%) and gastropods (40.47%), and in smaller quantities crabs (26.19%), urchins 9.52%) and polychaetes (7.14%). Inorganic substances were also found in the stomachs. According the results the warty crab consume more hard-shelled pray owing to their high availability in the habitat. The results of this research can contribute to a better knowledge of the biological characteristics of the species *E. verrucosa*.

**Keywords:** Decapoda, *Eriphia verrucosa*, diet, Adriatic Sea.

## Increase in Positive Temperature Anomalies in Algerian Surface Water and Its Impact on Marine Biodiversity

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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Like the world marine resource, the Algerian marine resource is under a certain number of pressures which make it more and more vulnerable. In this study, we highlight the increase observed in positive anomaly of temperature over fifty years and its impact on marine resource. For that, we calculated temperature anomalies from 1960 to 2014 for 10m, 50m and 150m depth for the three sectors of Algerian coast. After that, we analyzed the species which were reported and those not reported during the Algerian demersal resource assessment campaigns of 1982 in comparison with those of 2012 and we tried to establish a link with the increase in water temperature. The results show that the frequencies of occurrence of hot anomalies have increased over time, and we have observed the appearance or progression of species with hot affinity and the disappearance of species with cold affinity. These results are consistent with the scenario of "meridionalisation" of the Mediterranean Sea as well as the predictions made by the IPCC, i.e. a return to a biodiversity already present in the Pliocene.

**Keywords:** Algerian coast, temperature anomalies, marine resources, meridionalisation.

# Ichthyological Inventory and Classification of Lake Ecosystems in the Eastern and Western Regions of Algeria and Their Fish Farming Potential

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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The aim of this present work is to study and inventory the fish of Algerian freshwater, to give a list of an autochthons and introduces species, by compared our results with other researches. The Fish inventory consists for evaluating and identification of biodiversity by fishing and by field survey. We had rescented 25 species of fishes: 64% of fish are introduces and 34% are the autochthons species with one endemic specie *Aphanius apodus*. We explained our results that we have studied only a dams of Algeria, so for this, our fish diversity was less than the results for Chaibi, 2014, which they studied the fishes biodiversity in all freshwater and in Sahara. A comparison of biodiversity, a new species of fish (*Gymnocephalus cernuus*) was recovered at Koudiat Medouar dam in batna and signaled by Arab et al, 2020. Sadly, a lot of species are disparated or menaced for disparition because a various factor: pollution, eutrophication, and overfishing, Drought, and water sludge. Secondly, we had evaluated the fish potential for Algerian freshwater so 44% have a good fish potential, 21% have an excellent potential, 16% have an average potential and finally 19 % with a poor potential. Several repopulation campaigns of Algerians dams were done by introduced of Carps, Tilapia, Sander and black bass. we had also study the impact of fish introducing in fish biodiversity.

Acknowledgment. The authors thank to the fishermen for their cooperation.

**Keywords:** Biodiversity, Fish, Lake Ecosystem, Fish, Algeria.

## Morphological Characterization of Four Gobies from the Black Sea

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

Uğur KARADURMUŞ<sup>1</sup>, Dilek USTAOĞLU<sup>2</sup>, Rafet Çağrı ÖZTÜRK<sup>2</sup>, Yahya TERZI<sup>2</sup>, Mehmet AYDIN<sup>3,\*</sup>

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The teleost family Gobiidae (Perciformes) comprises at least 2000 species with, many still undiscovered or undescribed belonging to more than 200 genera. There are 74 goby species in the Black Sea and the Mediterranean Sea, 35 of them were reported from the coasts of Turkey. A reliable checklist of the Black Sea gobiid species fauna is still missing. The objective of the present study was to analyze the morphometric variations of the four presumed taxa within the *Gobies*, viz. *Gobies paganellus*, *G. niger*, *Mesogobius batrachocephalus* and *Neogobius melanostomus*. This study was carried out along the Turkish coast of the Black Sea from Hopa to Samsun between January 2018 and December 2020. Traditional morphometric characters were measured in 302 fish samples. Specimens were caught by gill net and trammel net with different mesh sizes up to 100 m in depth. Intraspecific variations of morphological characters relative to body size total length (TL) were revealed for each species. The undamaged specimens were analyzed in fresh condition. Morphometric data were measured with an electronic caliper to the nearest 0.01 mm and weighed to the nearest 0.01 g. Sex was determined macroscopically according to gonadal appearance. The univariate (ANOVA) and multivariate (Principal component analysis, PCA) analyses showed that *G. paganellus* and *G. niger* have overlapping morphological characteristics, whereas *M. batrachocephalus* differed distinctly. *N. melanostomus* separated from the other species by the highest body depth and caudal peduncle depth. The first two principal components (PC1, PC2) explained 92.9% of the variation between the species. Morphological characters that distinguish the species of Gobies are few and often hard to discern, thus the confusion in the taxonomy of this group at genus and species levels. This study explains morphological differences and a means of accurately identifying the four species of Gobies caught in the Turkish coastal waters of the Black Sea.

**Keywords:** Gobiidae, Taxonomy, Fish morphology, Black Sea.

## The Bacteriological Quality of the Waters of Lake Reghaia, East of Algiers, Algeria

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

**Sonia OULD ROUIS<sup>1,\*</sup>, Faiza ALLIOUCHE<sup>1, 2</sup>, Hassiba MANSOURI<sup>1</sup>,  
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Nowadays, water is a scarce resource and the deterioration of its quality is a major challenge for the future years. In this study we are interested in the waters of Réghaia lake, a nature reserve of international importance which also represents a coastal biotope for many living beings. Unfortunately, the nature of its waters is deteriorating day by day because they mix directly with urban, industrial and agricultural discharges. Our objective is to estimate the bacteriological quality of these waters subjected to various types of pollution. Thus, surface and deep samples were taken in 2013 upstream, in the middle and downstream of the lake. Bacteriological analyzes have shown that the waters are contaminated with faecal streptococci, particularly upstream. However, coliforms are present but to a much lesser degree. The absence of pathogenic germs such as Salmonella and Vibrio's is reassuring. This form of contamination indicates a real faecal peril that necessarily requires rigorous control without which, the water intended for irrigation will be unclean and of poor quality. Finally, we hope that this Ramsar site can be carefully preserved in order to protect the great diversity of fauna and flora that characterizes the reserve as well as the variety of ecosystems it shelters.

**Keywords:** Kruskal-Wallis Test, Coastal Biotope, Natural Reserve, Faecal Pollution, Coliforms.

## Growth and Condition Factor in Carp of a Hydrosystem in Southeast Algiers, Algeria

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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The Common Carp (*Cyprinus carpio*) is one of the major species of worldwide aquaculture. Since its introduction in the Hamiz dam, no data concerning the growth and body condition of this species in this hydrosystem have been published. For this purpose, this study was carried out to determine the type of growth, the length-weight relationship and the condition factor. Sampling of this allochthonous species was monthly, carried out using gillnets of different mesh sizes and carried out during 2012-2015.

Of the carp caught, there are 48% males, 32% females and 20% immature. The total length (48.5 cm) was recorded in a female carp while the maximum weight (1153g) was reached by a male carp. The length-weight relationship (all sexes combined) calculated is estimated at  $W = 0.0152 L^{2.88}$  and the correlation coefficient ( $r = 0.99$ ) indicates a strong intensity of correlation between the two variables total weight (Wt) and total length (Lt).

*Cyprinus carpio* from Hamiz dam appears to be small compared to the maximum recorded size of 120 cm (Froese and Pauly, 2016). However, monitoring of the condition factor (K), throughout our study, reveals that this species is well adapted to the environmental conditions offered by the waters of the dam lake.

**Keywords:** *Cyprinus carpio*, Length-Weight Relationship, Water Quality, Hamiz Reservoir, Correlation Coefficient.



## Evaluation of Growth Performance of Lettuce (*Lactuca Sativa* L) Integrated with Tilapia (*Oreochromis sp*) using an Aquaponics' System

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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<sup>1</sup>Diversity of Ecosystems and Systèmes Dynamiques of Agricoles Production en Zones Arides Laboratory, Biskra, Algeria.

There is a considerable interest in aquaponics as an innovative and integrated food production system that combines recirculating aquaculture and hydroponic system. However, limited studies have been carried about the application of aquaponics in developing countries. This research focuses on evaluating the growth parameters of lettuce integrated with Tilapia fish cultured in aquaponics recirculation system with locally available materials in arid regions in Algeria. For this purpose, the concentrations of ammonia, nitrite and nitrate of the water in the fish tanks and hydroponic units were weekly measured, as well as the temperature, pH and electric conductivity were measured continuously as an indication of the water quality. Plant growth parameters including shoots and roots fresh weights, plant height, root length, and the length and width of leaves were determined. As well as the weight and length of Tilapia were taken. The results showed that there were a noticeable fluctuations in the concentrations of ammonia, nitrite and nitrate which is a result of the nitrification and nutrient uptake process. At the end of the trial, the lettuce crops showed a good agronomic performance with an average weight per plant of 222.88 g and a final plant height of 30 cm. On the other hand, a significant increase in Tilapia weight was observed and the fish attained an average body weight of 250 g. It was concluded that the nitrogenous waste produced by fish has supported the biomass of lettuce in the aquaponics system and the waste uptake of this extractive species is sufficiently efficient for water reuse for tilapia rearing.

**Keywords:** Aquaponics, Nutrients, Aquaculture waste, Plant growth, Tilapia.

## Population and Growth Parameters of *Symphodus roissali* in the Southern Black Sea

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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Determination of population parameters of species is an important essence in the effective management and protection of marine ecosystems. If species show morphological differences between populations these parameters become even more important. *Symphodus roissali* (Risso, 1810) belonged to the family Labridae is common on the Southern Black Sea coasts. This study aims to give an understanding of the current situation of *Symphodus roissali* in Black Sea ecosystem by estimating the population parameters while constructing a reference base for other researches focusing on this species. 1240 individuals were sampled between November 2020 to October 2021. The mean length of the sampled individuals was calculated as 113.54 mm  $\pm$  0.43 and the mean weight was calculated as 25.23 g  $\pm$  0.31. Sagittal otoliths were used for age determination and it was determined that 45.2% of the individuals were 1 year old. The Female: Male ratio was determined as 1:1.34 where the dominance of the male individuals in the population was found to be statistically significant with values of  $\chi^2=26.129$  and  $p<0.001$ . The growth parameters were estimated as  $L_{\infty}=214.8$  mm,  $W_{\infty}=173.57$  g,  $k=0.186$  years<sup>-1</sup>,  $t_0=-2.563$ ,  $\Phi=1.93$  by utilizing the Bertalanffy equation. Relative fecundity was calculated as 8676.6 units/gr and the egg diameter was calculated as 588.8  $\mu$ m  $\pm$  10.59. It is concluded that *S. roissali* has a better growth performance in the Southern Black Sea within the temperature range of 10 °C to 19 °C where the breeding season starts and ends respectively.

Acknowledgment. This work is a part of my master thesis 'Morphometry and Growth Parameters of *Symphodus roissali* (Labridae) in Southern Black Sea', and this thesis is supported by Ordu University, Scientific Research Project Coordination Unit (B-2116).

**Keywords:** *Symphodus roissali*, Growth rate, population parameters, breeding.

## Criticality Analysis of the idealized Two-layer Bosphorus Flow by Direct Tracking of Interfacial Waves with a 3D Ocean Model

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

Adil SÖZER<sup>1</sup>

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Being the narrowest part of the Turkish Straits System, Bosphorus strait is the most critical element of the water pathway between the Mediterranean and the Black Sea. The driving force of the two-layer Bosphorus exchange flow is the density difference between the two ends of the strait, favoring a subsurface flow of saltier water towards the Black Sea and the compensation flow of the less dense waters near the surface in the opposite direction. The topographic features of the Bosphorus Strait and their combined effects with suitable reservoir conditions supporting hydraulic controls yield a unique environment which the Bosphorus flow is ideally suited to support ‘maximal-exchange’ regime where the two-layer exchange through the strait is determined by the geometry of the channel, the density difference between the layers and the net barotropic volume-flux. In this study, the criticality of the Bosphorus flow at topographic constrictions is investigated by following an interfacial displacement superposed on a steady-state solution obtained by a three-dimensional idealized geometry Bosphorus model discretized on a high resolution curvilinear grid by utilizing a 3D ocean model. The initial disturbance of the interface is realized by tilting the salinity interface upwards with a vertical displacement and the model is restarted from the steady-state solution while the propagation of the disturbance signal is followed. Experiment with a steady-state solution representing the maximal-exchange characteristics supported by the two hydraulic controls and a case with a drowned control at the contraction produced by altering the reservoir stratification at the south reservoir have been performed. The propagation speeds for experiments are found to be consistent, justifying the expectation that the tracked waves are analogous to the long waves at a density interface in a two-layer inviscid flow. Direct tracking of the interfacial waves is successfully performed for differentiation of the controlled and uncontrolled flows for the idealized Bosphorus representation, which can be further extended to fully realistic conditions.

**Keywords:** Bosphorus Strait, Controlled flow, Ocean model, Wave tracking.

## Seasonal Zooplankton Diversity and Its Relationship with Environmental Factors of Kerrada Reservoir, Northwest Algeria (Mostaganem)

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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Zooplankton is a very important component of aquatic ecosystem. It is the second link in the food chain, transmitting energy from primary producers to higher trophic levels. The temporal and spatial evolution of zooplankton communities depends primarily on abiotic and biotic conditions, as well as anthropogenic factors. Therefore, a change in environmental conditions can affect all or part of those communities. This part of our research work aims to study on a seasonal basis, the relationship between water quality and zooplankton diversity of an artificial aquatic ecosystem. Our study was conducted by sampling zooplankton from Kerrada storage reservoir, which is used for satisfying the drinking and industrial water production to the M.A.O. corridor (Mostaganem, Arzew and Oran). The originality of our reported results is strengthened by the fact that there are no previous available references that have already studied this freshwater ecosystem before this one. Zooplankton and water samples were collected monthly for a year (September 2021– august 2022) at four stations, spread over Kerrada reservoir. Fifteen physical and chemical variables were recorded; temperature, pH, conductivity, salinity, dissolved oxygen, redox potential, MES, transparency, TDS, calcium, magnesium and nutrients ((nitrates, nitrites, ammonia and orthophosphate) for water quality monitoring. The zooplankton population collected in the Kerrada reservoir during the study period is formed of 13 taxa, belonging to the three main groups: Rotifers (6), Cladocerans (5) and Copepods (2). The distribution of zooplankton communities differs from one season to another. The Copepods group was quantitatively the most abundant group in all 4 seasons. Winter was the most diversified season. A low density of Rotifer species which is due to the increase in density of Cladoceran species. Canonical Correspondence Analysis (CCA) revealed that the most significant environmental factors influencing zooplankton community were water temperature, dissolved oxygen (DO), pH and nutrients (Orthophosphate and nitrates).

**Keywords:** Environmental factors, freshwater ecosystem, Kerrada reservoir, Zooplankton.

## Effect of Replacing Fish Meal with Black Soldier Fly Meal on Growth of Red Tilapia *Oreochromis sp.*

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

**Sabrina HIDOUCI<sup>1,\*</sup>, Soufiane BENSALÉM<sup>1</sup>, Khouloud GHETTAS<sup>1</sup>, Khebab ALLAL<sup>2</sup>, Rayehana TEMIRA<sup>1</sup>**

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A 60-day feeding trial was conducted at the aquaculture laboratory at Kasdi Merbah Ouargla University, to assess the effects of substituting fishmeal with black soldier fly (BSF) larvae meal on growth performance, survival rates and fillet quality of red tilapia (*Oreochromis sp.*). Two test diets were formulated, one with fish meal (AFP), the other with meal from black soldier fly larvae (BSF). Growth and feed utilization for *Oreochromis Sp.* recorded an average of  $2.36 \pm 0.18\%$  for BSF feed and  $2.70 \pm 0.10\%$  for AFP feed. For the TCA, we record 2.69 and 2.16 respectively. There is therefore convergence and similarity between the BSF feed and the AFP feed, except that the latter has a slightly better growth performance. The survival rate is similar, and varies between 84 and 90%. As for the physical and chemical factors, they are in accordance with the standards of breeding waters. In conclusion, the lack of differences between fish growth performance, feed utilization and body composition under the two diets tested indicates that full-fat BSF can replace fishmeal without negative effects on fish meal red tilapia (*Oreochromis Sp.*)

**Keywords:** Red tilapia, black soldier fly, diet, growth, fillet quality.

## Assessing the Impact of Dietary Supplement, Alginate/Spirulina (*Spirulina platensis*) on Growth Performance of Tilapia *Oreochromis Sp.*

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

**Soufiane BENSALEM<sup>1,2,\*</sup>, Messouda NAAMI<sup>1</sup>, Khadidja ROUAI<sup>1</sup>, Sabrina HIDOUCI<sup>1</sup>, Boualem HAMDI<sup>2</sup>**

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A dietary supplement are gaining wide acceptance in livestock production, and may be applicable to aquaculture production systems. This study was performed to investigate the effect of the dietary supplementation of alginate/ Spirulina (*Spirulina platensis*) on growth performance of juveniles of Tilapia, *Oreochromis sp.* at three different concentrations (0 %, 5% and 10%). Each diet was fed to duplicate groups of fish with a mean initial body weight of  $0.8 \pm 0.05$  g for eight weeks feeding period and was distributed on 6 tanks of 8.4 L. The results indicate that no changes were noticed on survival among treatment ( $p > 0.05$ ). The inclusion of alginate/ Spirulina induced a significant increase on the growth and feed conversion ratio ( $p < 0.05$ ). However, no different impact was observed between the treatment 5 % and 10%. In conclusion, supplementation of Tilapia diet with alginate/ Spirulina (*Spirulina platensis*) can improve growth performance of tilapia juveniles.

**Keywords:** Alginate/Spirulina, Dietary Supplement, Tilapia, *Oreochromis Sp.*, Growth.

## Influence of Temperature Changes on Phytoplankton Community Structure in the Surface Water Layer of Varna Bay (1992-2020)

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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During the last decades, an increase in the sea surface temperature (SST) in the Black Sea has been registered. The SST in the Varna Bay has been rising by 0.06 °C/year in the period May – August 1992–2020. The purpose of this study (not done before in the coastal water in the Bulgarian Black Sea) is to establish the influence of the rising SST on the size structure and taxonomic structure of the phytoplankton and to define what part of this dynamics results from the temperature change. Analyses of 473 phytoplankton samples and SST data were performed using standard methodology. The relationship between SST and the abundance and biomass of nano- and micro-phytoplankton and main taxonomic groups were established by Bivariate correlation and Nonlinear regression analyses. The results show that the influence of the rising SST is statistically significant on the decrease of the abundance of nano-phytoplankton, the decrease of the abundance and biomass of the micro-phytoplankton and diatoms as well as on the decrease of the biomass of the group Other. In this study we established that about 30 – 40% of the long-term yearly changes in the phytoplankton qualitative and quantitative structure could be explained by changes in SST.

**Keywords:** Black Sea, Varna Bay, SST, phytoplankton, size structure, taxonomic structure.

# Estimates of Population Dynamics Parameters of Red Porgy (*Pagrus pagrus* Linnaeus, 1857) In the Central Algerian Coast (Southwestern Mediterranean)

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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The understanding of life history traits, particularly the growth and age of species, provides a basis for knowledge of longevity, age at recruitment, age of sexual maturity, spawning period, migration and mortality. These growth data make it possible to study demographic structure and population dynamics through models based on age structure. Belonging to the Sparidae the red porgy (*Pagrus pagrus*) is an important component of the Algerian fishery. However, no information is available on this species life history in south western Mediterranean Sea and there are very little data in this sea and in the world. The aim of the current study is to estimate the main biological parameters, including growth parameters, mortalities and exploitation rate for *Pagrus pagrus*. A total of 449 specimens of *P. pagrus* were sampled from the commercial fishery in the central part of the Algerian coast. The samples were collected monthly. The fish ranged in total length from 10.1cm to 51.2cm. Sex ratio, morphometric characteristics, age and growth for red porgy from central Algerian Coast (Southwestern Mediterranean Sea) were examined. For age estimation, otoliths immersed in water were scanned with Epson Pro V750 and the images were saved on a computer disc. Each otolith was then analyzed using the TNPC software. According to the age reading, distribution varied from 0 to 11 year. Von Bertalanffy growth model parameters were  $L_{\infty}=72.77$  cm,  $K=0.08/\text{yr}$ , and  $t_0=-1.24$  years for all aged fish. Estimate of total instantaneous mortality was  $0.59/\text{yr}$ . The natural mortality (M) of the red porgy population, calculated using the growth parameters, recorded the values of  $0.16/\text{yr}$ . fishing mortality (F) and current exploitation rate were estimated as  $0.43 \text{ year}/\text{yr}$ , and  $0.73$  respectively. The red porgy population is lightly exploited, though its stock is fishing mortality dominated. However, the comparatively lower length at first capture in relation to the length at first maturity exposed the existence of growth overfishing within the *P. pagrus* population. The fishery of *P. pagrus* fell within the developed, as such any increase in fishing effort to maximize yield per recruit will breakdown the fishery.

**Keywords:** Red porgy, Algerian fisheries, Sparidae, population dynamics.



## Impact of Artisanal and Recreational Fishing on the Ichthyofauna of the Bab El Oued - Ain Benian Area

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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The fisheries with its auto-renewable are in decline, caused by several factors. The preservation of a sustainable resource requires serious and punctual studies and monitoring through all the existing parameters that interact with it (environmental effects and human beings), in order to understand its behavior. The study that has just been presented focuses on the impact exerted by the artisanal and recreational fishing effort in an area of 16km of coastline that includes five coastal municipalities. Data collection based on observation and survey carried out at 22 sites has indicated the presence of 26 artisanal fishing boats and 262 recreational fishing boats. The simplicity of the techniques used in the artisanal and recreational fisheries does not influence the importance of the quantities caught. The number of fishermen and the size of the catches reflect the existence of a direct impact on the ichthyofauna present in the area, targeting essentially the two species *Mullus barbatus* (Red mullet) of the family Mullidae, with a frequency of capture of  $50 \pm 5.89\%$  caught by the artisanal fishing vessels, and *Diplodus sargus* (Sar) of the family Sparidae, with a frequency of capture of  $45.83 \pm 3.08\%$  by the recreational fishermen. The common species caught are of the family Sparidae represented by  $36.36 \pm 1.85\%$ . The results of this study, which are represented by a work carried out in a very short period (two months), lead us to consider other perspectives: -To extend the survey period and the competence to elaborate a statistical and biological database in the area, in order to better structure the state of the stocks and the impact on the ichthyofauna. Implement a monitoring of the status of the Red mullet and Sar stocks in order to avoid a collapse of the resource (the two most targeted species). Consider carrying out an approach linking different species to different fishing gears in order to know the impact that this effort has on the stock (multi-species/multi-fishing gears approach).

**Keywords:** Impact, fishing gears, artisanal fishing, recreational fishing.

## Application of a SWOT Tool on Algerian Aquaculture Farms

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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In Algeria, aquaculture is in full development; aquaculture farm projects for both marine and freshwater species designed to meet the needs of the fish market and to increase in fish production. However, the contributions from these activities remain weak and insufficient. Thus, and in order to understand the dysfunctions at the origin of this problem, in the present study, aquaculture farms, in particular marine fish farming, have been analyzed using a management tool, in this case SWOT (Strengths, Weaknesses, Opportunities, Threats), combined with the AHP (Analytic Hierarchy Process). Surveys have been carried out among investors of aquaculture farms, order to gather the data necessary for the analysis. It emerges from the priority threats and weaknesses affecting the global environment of these enterprises, such as the absence of a structured market for aquaculture products, the climate change and the health crisis which blocked imports of raw materials (fingerlings, fish feed...) and reduced the workforce at farm level (containment) . The impact of the latter covers that of factors of forces and opportunities, in this case, the quality of the juvenile fish and the food, which remains low for the development of fish production. Thus, in order to hope for a balanced environment and therefore a better performance of aquaculture farms in question, it is recommended a strategy based on the improvement of strengths and opportunities of these companies and the reduction of their weaknesses and threats that affect them.

**Keywords:** Fish farming, SWOT, aquaculture exploitations, Algeria.

## Cigarette Butts Pollution in Trabzon Coast, SE Black Sea

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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**Introduction.** Marine litter pollution and its impact on the marine environment have grown a global concern in recent decades (Bergmann et al., 2015). Consumer behavior especially single-use items is believed to have generated anthropogenic litter in the environment. Exacerbated by waste mismanagement and lack of awareness this litter eventually enters and accumulated mainly in the marine environment. Clean-up actions were carried out within the scope 785 BSB LitOUTer EU Project to raise public awareness regarding marine litter. This study aims to determine cigarette butts' pollution in Trabzon, Southeast Black Sea.

**Materials and Methods.** In this study, the presence and abundance of cigarette butts that have the potential to be transported to the sea by precipitation and sewage-related transport in three sites were evaluated. Sample locations were determined based on clean-up activities participated by volunteers. Sampling sites are described as public open-access no-commercial areas such as parks and beaches. The first site was located in the KTÜ Kanuni Campus, the second site was Of - Kırıkcık beach and the third station was Ayasofya beach.

**Results and Discussions.** Based on the results of this study, cigarette butts constitute the largest portion of plastic waste. A total of 6941 cigarette butts were collected and removed from the sites. The average cigarette butt concentration was 3.3 m<sup>-2</sup>. Cigarette butts' litter was unevenly distributed among the sites. However, cigarette butts' litter was higher in busier places such as campus parks. A high amount of cigarette butts also indicated false perception regarding cigarette butts which are made of plastic-containing materials and can reach up to more than ten years to decompose. This litter can be washed into rivers, lakes, and oceans eaten by birds, animals, and fish, and most littered in the Black Sea.

**Acknowledgment.** This study was carried out within the scope of the EU, CBC, BSB 785 LitOUTer Project "Raising Public Awareness and Reducing Marine Litter for Protection of the Black Sea Ecosystem". In addition, the author would like to appreciate to all the beach clean-up participants in Trabzon

**Keywords:** Marine litter; cigarette butts; nicotine; clean-up; Black Sea.

## Evaluation of Water and Sediment Heavy Metal Samples of Beyşehir Lake by Geographical Information Systems

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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Increasing human pressure on water resources has brought along the problem of pollution in fresh waters. This situation, which is a current problem, requires studies to determine and evaluate the quality of water resources. Beyşehir Lake is also Turkey's largest natural freshwater lake, with an altitude of 1.150 m and an area of approximately 65.000 hectares. Located within the borders of Konya and Isparta provinces, the lake and its surroundings; The National Park Conservation Area, Drinking and Irrigation Water Reserve Protection Area is within the scope of the internationally important group A wetland. In this study; Turkey's largest freshwater lake is Lake Beyşehir in terms of heavy metal parameters Geographic Information Systems (GIS) aimed to evaluate with. Within the scope of the study, seasonal samples were taken from 23 different stations from the Beyşehir Lake water and sediment samples and measurements were made. Heavy metal concentrations detected in water; the Surface Water Quality Regulation has been evaluated according to the Continental Water Resources Classes, the World Health Organization (WHO), the American Environmental Agency (US Environmental Protection Agency, EPA) and the European Commission (European Commission, EC) drinking water standards. The values determined in the sediment were evaluated according to the consensus-based Sediment Quality Directive (SQG) developed by MacDonald et al. (2000). The data was examined positionally with GIS. Spatial analysis and mapping of data was created using ArcGIS program. While the average concentrations in Beyşehir Lake water samples were determined below the reference criteria, arsenic (As), chromium (Cr) and nickel (Ni) in sediment samples were found at remarkable levels. The results obtained revealed that the Beyşehir Lake should be preserved at the heavy metal point.

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**Keywords:** Beyşehir Lake, Heavy Metal, Geographic Information Systems, Arsenic, Drinking Water.

## The „EcoeFISHent” Project – Sustainable Fish Waste Managing System

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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Global population is rapidly growing and expected to increase its economic needs significantly in the following decades. Sustainable supply and efficient resource management is essential for the functioning of modern societies. This includes exploration, extraction, processing, re-use, recycling and substitution of raw materials. “EcoeFISHent” is a project funded by the European Union programme H2020 (GA 101036428), which aims to develop an industrial symbiosis system, able to efficiently exploit fish-processing side streams by obtaining a variety of valuable supplements. It involves a consortium of thirty-four parties, representatives of different sectors and EU contribution of € 15 145 267, 12. NASEKOMO’s mission in the “EcoeFISHent” project is to develop a methodology to convert fishing and fish-industry side streams into added value resources for: cosmetics, nutraceutical, agriculture, energy and packaging sector, such as soil fertilizers, oil and chitin through Black soldier fly (*Hermetia illucens*) farming. The larvae of the BSF are able to decompose various types of organic waste and converts them into biomass, which can subsequently undergo chitin and oil extraction. As a result of the BSF larvae life cycle, a rich fertilizer will be produced, boosting the growth of leafy plants and vegetables, rejuvenating soil, and ensuring even and continual plant growth. Based on fishing industry and aquaculture side-streams fed larvae, valuable ingredients will be produced and converted into products by other members of the “EcoeFISHent” consortium, to implement a no-waste cluster.

**Keywords:** Sustainability, aquaculture, black soldier fly.

## Estimating Submarine Groundwater Discharge into the Cilician Basin

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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Groundwater often contains high amounts of nutrients, heavy metals, and other pollutants that are transported into aquatic environments. In fact, excessive nutrient input can cause eutrophication and, as a result, algal blooms, which can harm aquatic ecosystems. Such enhanced primary productivity reduces water quality and may cause hypoxic/anoxic conditions that impact fish and invertebrate habitats. Although the impacts of submarine groundwater discharge are known to be prominent, SGD's spatiotemporal heterogeneity requires research at the necessary temporal and spatial scales. Hydrological and meteorological conditions in different seasons, geophysical and morphological structures of aquifers, and anthropogenic factors, especially agricultural and industrial pressure, are the main reasons for this heterogeneity seen in submarine groundwater. Changing climatic conditions and increasing anthropogenic pressures have given substantial importance to submarine groundwater discharge studies in terms of accurate determination of water, nutrient, and pollutant budgets.

The objective of this study is to quantify the submarine groundwater discharge (SGD) and associated nutrient fluxes in the Cilician Basin by using a <sup>228</sup>Ra isotope mass balance approach, which has been extensively utilized as a tracer of SGD input due to its higher concentration in groundwater. Thus, by taking SGD into consideration, well-defined water and nutrient budgets can be developed for a better understanding of biogeochemical and hydrological dynamics in the Cilician Basin. We have conducted two seasonal basin-scale cruises and two catchment expeditions for <sup>228</sup>Ra sampling. Furthermore, monthly nutrient sampling was conducted in the catchment's eight largest rivers and eight wells (from Anamur to Samandag) to represent the hydrological and geological characteristics of the study area. Here, we present preliminary results of the

residence time of the Cilician Basin, river fluxes and associated total suspended sediments, temperature, and salinity profiles of the basin for both wet and dry seasons separately.

Acknowledgment. This study is funded by The Scientific and Technological Research Council of Türkiye (TÜBİTAK, 120Y082) and The Marine Ecosystem and Climate Research Center (DEKOSIM).

**Keywords:** Land-sea interactions, eutrophication, coastal management, groundwater, radioisotopes.

## The Correlation Between Fat Content and Condition Factor of Sprat (*Sprattus sprattus*) In The South-Eastern Black Sea

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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The monitoring of the processes that may occur in the Black Sea Pelagic ecosystem (water temperature, planktonic biomass, fat content in fish, etc.) allows us to understand the ecosystem trend and the status of the stocks. In addition, knowledge of the structure, distribution and migration of fish stocks provides opportunities for facilitating fisheries management of the target species. In this study, the results of the nutrient components and condition factor were obtained from the sampled sprat that was caught monthly between the years of 2017-2022 from the Turkish coasts of the Black Sea. Considering the monthly samples, sprats have tolerance to cold water and consume oil in the winter months (monthly average body oil rates in January 2.78%, in February 1.33%, in March 0.69%), and accumulate body oil in the beginning of spring and summer (in April 2.34% in May, 3.14%, in August, 3.91%), also it was observed that sprat continued to eat and increased the body fat rate in fall months (6.6% in September, 6.4% in October, 4.92% in November). According to result of condition factor of sprats, it was observed that there is a similar trend with the oil content of fish, sprat had the lowest condition factor (0.53) in the winter months that is breeding season, and it was increased in spring and summer months then reached to the highest values (0.62) in the autumn months. In addition, the highest rate of moisture (78.85%) in sprat meat were determined in the winter months when the oil content is the lowest. Also, it was determined that the amount of protein in sprat varied between 15.19-17.98%, and the amount of ash detected in the composites was between 1-2%. In general, the nutritional components of fish meat vary according to the fish size, species, age, feeding environment, nutrient content of consumed feed and fish breeding-migration season.

Acknowledgment. This study was carried out within the scope of Ministry Of Agriculture And Forestry, General Directorate of Agricultural Research and Policies (TAGEM) by project titled “Monitoring the commercial pelagic fish stoks in Black Sea region”. In addition, we would like to express our gratitude to the project's personnel for their contributions

**Keywords:** Sprat, Fat content, Condition factor, Black Sea



## Estimation of Size at First Maturity of Sprat (*Sprattus sprattus*) In The South-Eastern Black Sea

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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The subject of this study is the estimation of the first breeding length of sprat one of the commercially important fish species of the Black Sea. During the breeding period between 2017-2021, a total of 2287 samples were collected between November and March, and the total length, body weight, sex and sexual maturity status of the sampled fish were determined. The female/male individual ratio was calculated as 1:0.59. Mean total length was determined as  $8.40 \pm 0.059$  cm and  $8.18 \pm 0.062$  cm in female and male individuals, and mean body weight was determined as  $3.86 \pm 0.063$  g and  $3.42 \pm 0.074$  g, respectively. The length-weight relationship equation was estimated as  $W=0.0034 L^{3.2666}$  for females,  $W = 0.0038 L^{3.2037}$  for males, and  $W = 0.0035 L^{3.251}$  for both.

The length at first sexual maturity was estimated at 5.76 cm for both sexes. The share of fish smaller than 5.76 cm in the sampled fish was determined as 0.65% (15 pieces). Determining the initial spawn size provides opportunities for facilitating fisheries management of the target species. However, according to the information obtained from the literature, the decrease in the first breeding length (7 cm) compared to previous years can be explained not only by fishery (fishing pressure) but also by environmental parameters and the cyclical nature of the stock.

Acknowledgment. This study was carried out within the scope of Tarım ve Orman Bakanlığı, TAGEM “Karadeniz’deki Ekonomik Önele Sahip Pelajik Balık Stoklarının İzlenmesi”. In addition, we would like to express our gratitude to the project's personnel for their contributions.

**Keywords:** Sprat, Maturity, Black Sea.

## Groundwater and Surface Water Monthly Nutrient Discharges into the Cilician Basin

Tuesday, 25<sup>th</sup> October – 13:00 – Observation Terrace – Poster

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Coastal waters are dynamic ecosystems quickly responding to natural and anthropogenic environmental changes such as climate change and nutrient fluxes in the the surrounding landscape. These changes can also alter coastal food webs and ecosystem structures. Since natural or anthropogenic impacts can affect the interactions between the land and the ocean, urban development has dramatic effect on coastal ecosystems. Even without any anthropogenic contamination, water coming from the coastal catchments contains varying concentrations of nutrients. However, coastal systems become enriched with nutrients due to improper handling pf sewage and agricultural runoff. Since coastal eutrophication's major cause is anthropogenic nutrient enrichment, nutrient flow from surface water and groundwater is a crucial source for estimating these effects. Monitoring groundwater and surface water may help us to understand these fluxes' seasonal variation and potential contribution to coastal eutrophication. We will also try to figure out how much surface and underground fluxes contribute to eutrophication in the Mediterranean Sea as a whole. We surveyed nine major rivers and nine corresponding water wells in the coastal zone of Cilician Basin monthly from December 2021 to October 2022. Here we present preliminary results of conductivity ( $\mu\text{S}/\text{cm}$ ), temperature ( $^{\circ}\text{C}$ ), nutrients ( $\text{NO}_3^-$ ,  $\text{NO}_2^-$ ,  $\text{Si}(\text{OH})_4$ , and  $\text{o-PO}_4^{+}$ ,  $\text{NH}_4$ ), groundwater and surface waters in relation to the meteorological data for the entire basin. With this study, we will understand the spatial-temporal nutrient variations of underground and surface water feeding the Cilician coastal waters using monthly monitoring. This approach will lead us to the relative contributions of the ground and surface water nutrient inputs to the annual budgets of reactive nutrients driving the Cilician coastal productivity.

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**Keywords:** Groundwater, Salinity, Monitoring, Eutrophication.